87 01320

October 1975 final
(Supplement to August 1975 Draft)

Environmental Impact Report
Dow Petrochemical Project

Pittsburg Expansion
Contra Costa County

Montezuma Site
Solano County



INSTITUTE OF GOVERNMENTAL STUDIES LIBRARY
UNIVERSITY OF CALIFORNIA

Solano County Planning Department
Contra Costa County Planning Department
with technical assistance by
J. B Gilbert & Associates

INSTITUTE OF GOVERNMENTAL STUDIES LIBRARY
UNIVERSITY OF CALIFORNIA

Solano County Planning Department
COURTHOUSE · FAIRFIELD, CALIFORNIA · 94533 · (707) 429-6561

Steve
Summary
for K. + E. ?
Discuss with
them first.

October 23, 1975

Attached is a copy of the Summary of Comments received and the responses thereto concerning the Draft EIR for the Dow Petrochemical Project three miles east of Collinsville in Solano County.

At its meeting of October 16, the Solano County Planning Commission recommended that the Board of Supervisors adopt and certify the EIR. The Commission further recommended that the Board of Supervisors cancel the Agricultural Preserve Contract and grant the rezoning request, which has been reduced to 834 acres. The Board will consider these items at 10:00 a.m. on November 4 in the Board Chambers.

I appreciate your assistance in review of this EIR.

Very truly yours,

Clayne E. Munk
Clayne E. Munk
Planning Director

CEM:MH:ec
Attachment

11-2084

October 1975 final
(Supplement to August 1975 Draft)

Environmental Impact Report
Dow Petrochemical Project

Pittsburg Expansion
Contra Costa County

Montezuma Site
Solano County



Solano County Planning Department
Contra Costa County Planning Department
with technical assistance by
J. B. Gilbert & Associates


Digitized by the Internet Archive
in 2024

https://archive.org/details/C124892444

TABLE OF CONTENTS

PREFACE 1

CHAPTER I
INTRODUCTION I-1

CHAPTER II
SUMMARY OF COMMENTS

Federal Agencies II-1
State Agencies II-2
Regional Agencies II-10
County Agencies II-12
Cities II-16
Local Agencies II-18
Environmental Groups II-20
Individuals II-32

CHAPTER III
GROWTH INDUCEMENT

Related, Indirect, and Induced Development III-1
Solano County Development III-6
Conclusions III-14
Mitigation III-15

CHAPTER IV
AIR QUALITY

Methodology and Assumptions IV-1
Effects of Pollutants IV-21
Other Responses to Specific Air Quality Comments . . . IV-25

CHAPTER V
WATER RESOURCES

Water System Description V-1
Environmental Impacts of Diversion/Discharge System . . V-5
Water Quality Standards in the Western Delta V-9
Effect of the Dow Project on the State Water
Project and Central Valley Project V-10
State-Supported Overland Water Supply Facilities . . . V-10

Payments by Dow for Providing Sufficient Delta Outflow V-12
Effects of Peripheral Canal on Maintenance Dredging V-12
Alternative Sources of Water as Mitigation V-12
Cooling Water System V-13
Impacts from Evaporation V-14
Solar Evaporation Ponds V-14
Use of Wells at Montezuma V-16
Collinsville Wastewater Problems V-16
Diversion Structure V-16
Rainfall Runoff V-17
Temperature Effects of Discharge V-18
Oil Discharge from Ballast of Tankers V-18
Dredging Impacts V-18
Erosion Control V-22
Marsh Protection V-27
Impact on Pleasure Boating V-27
Cumulative Water Impacts V-27
Mitigation Measures V-28

CHAPTER VI
HAZARDOUS WASTES

Group 1 Wastes VI-1
Industrial Wastes VI-1
Handling of Hazardous Waste Material VI-5
Hazardous Waste Impact VI-6
Transport of Waste Materials VI-6
Mitigation Measures VI-7

CHAPTER VII
PLANNING

Solano County VII-1
Contra Costa County VII-3
Sacramento County VII-7
Regional Plans VII-7
Alternative Sites VII-11
Mitigation VII-12

CHAPTER VIII
TRANSPORTATION

Existing Road Conditions VIII-1
Traffic VIII-1

Accidents VIII-9
Phase I Road Improvement and Maintenance VIII-10
Future Road Needs VIII-12
Mitigation Measures VIII-13

CHAPTER IX
WILDLIFE AND VEGETATION

Introduction IX-1
Vegetation IX-2
Description of Pittsburg Site IX-17
Description of Lower Sherman Island IX-26
Rare and Endangered Species IX-34
Impact of Construction at Montezuma Site IX-37
Effects Resulting from Modification of Vegetative Cover Types IX-38
Construction Impacts at Pittsburg Site IX-39
Construction Impact on Mammal Species - Both Sites . . IX-40
Operational Impacts on Wildlife IX-40
Mitigation Measures IX-43

CHAPTER X
ECONOMIC IMPACT

Local Tax Effects X-1
School Financing X-1
Water Supply Facilities X-4
Wastewater Facilities X-4
Mitigation Measures X-7

CHAPTER XI
WILLIAMSON ACT

Absence of Inconsistency with Purposes XI-1
The Public Interest XI-9
Nongrounds XI-11
Cumulative Impact XI-17
Size of Cancellation XI-18
Conclusion XI-20
Mitigation XI-21

CHAPTER XII
GEOLOGY, SOILS, AND SEISMICITY

Introduction XII-1
Site Plans and Large-Scale Geologic Maps XII-1

Site Preparation and Grading XII-4
Soils XII-6
Seismicity XII-9
Geologic and Soils Impacts XII-16

CHAPTER XIII
PIPELINES

Pipe Crossing Details XIII-1
Wildlife Impacts XIII-3
Pipeline Failure XIII-3
Mitigation Measures XIII-5

CHAPTER XIV
ACCIDENTAL SPILLS

Probability of Accidents XIV-2
Raw Materials XIV-4
Physical Properties of Chemicals XIV-5
Toxicity of Chemicals XIV-6
Spills of Petroleum and Hazardous Materials XIV-8
Dow Pittsburg Contingency Plan XIV-18
Mitigation Measures XIV-21

CHAPTER XV
NAVIGATION

Space XV-1
Controls XV-2
Aids to Navigation XV-4
Navigation Rules XV-4
Mitigation Measures XV-5

CHAPTER XVI
OTHER RESPONSES

Occupational Hazards XVI-1
Resource Conservation XVI-5
Individual Responses XVI-8

CHAPTER XVII
UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Construction Effects XVII-1
Operational Effects XVII-3
Secondary Effects XVII-5

Growth Inducement XVII-6
Problematical XVII-6

CHAPTER XVIII
MITIGATION MEASURES

Growth Inducement XVIII-1
Air Quality XVIII-2
Water Resources XVIII-3
Hazardous Wastes XVIII-4
Planning XVIII-5
Transportation XVIII-5
Wildlife and Vegetation XVIII-6
Economic Impact XVIII-8
Williamson Act XVIII-8
Geology, Soils and Seismicity XVIII-9
Pipelines XVIII-12
Accidental Spills XVIII-13
Shipping and Navigation XVIII-16
Occupational Hazards XVIII-16
Aesthetics XVIII-17
Energy XVIII-17
Noise XVIII-17

TABLES

TABLE III-1
Possible Approximate Employment and
Population Growth From Dow Project..... III-3

TABLE III-2
Community Populations..... III-5

TABLE IV-1
Conversion Factors for Figures IV-11 and IV-12..... IV-17

TABLE IV-2
Calculated Centerline 1-Hour Pollutant Concentrations
Resulting from Operation of Proposed Montezuma Plant..... IV-18

TABLE IV-3
Calculated Centerline 1-Hour Pollutant Concentrations
Resulting from Operation of Proposed Pittsburg Complex.... IV-18

TABLE IV-4
National Ambient Air Quality Standards..... IV-19

TABLE V-1
Effect of Project on Salinity at Chipps Island..... V-9

TABLE V-2
Erosion Control Specifications..... V-23

TABLE VI-1
Description of Solid and Liquid Waste Classification..... VI-2

TABLE VI-2
Classification of Waste Disposal Sites..... VI-3

TABLE VII-1
Employment in Major Economic Sectors..... VII-9

TABLE VII-2
Employment in Bay Region Counties..... VII-10

TABLE VII-3
Employment Growth Rates by Decade 1960-1990,
Bay Region and Counties..... VII-10

TABLE VIII-1
State Highway 12: Fairfield-Rio Vista..... VIII-2

TABLE VIII-2
Present Conditions of Collinsville Road and
Talbert Lane..... VIII-3

TABLE VIII-3
1974 Traffic Volumes Highway 12..... VIII-5

TABLE VIII-4
Traffic Counts on Solano County Roads in
Vicinity of Site..... VIII-6

TABLE VIII-5
1980 Traffic Projections Highway 12..... VIII-7

TABLE VIII-6
1980 Traffic Projections Solano County Roads..... VIII-9

TABLE VIII-7
Road Maintenance and Capital Cost Estimates
for County Roads..... VIII-11

TABLE X-1
Economic Impact Montezuma..... X-2

TABLE X-2
Economic Impact Pittsburg..... X-3

TABLE X-3
Status of Water Supply Facilities..... X-5

TABLE X-4
Status of Wastewater Facilities..... X-6

TABLE XI-1
Estimated 1974 Net Agricultural Value
Montezuma Property..... XI-12

TABLE XI-2
Use Characteristics of Land Not Under
Williamson Act Contracts Montezuma Site..... XI-15

TABLE XII-1
Estimated Earthquake Parameters..... XII-17

TABLE XIV-1
Summary of Anticipated Product and
Raw Material Shipments..... XIV-3

TABLE XIV-2
Physical Constants of Chemicals to be Handled..... XIV-5

TABLE XIV-3
Critical Concentrations..... XIV-6

TABLE XIV-4
Visible Effects of Oil Slicks on Water..... XIV-12

TABLE XIV-5
Effects of Crude Oil on Marsh Plants..... XIV-16

TABLE XVI-1
Growth Rates and Western Utilization
of Proposed Dow Product..... XVI-16

FIGURES

FIGURE IV-1
Trajectory A..... IV-3

FIGURE IV-2
Trajectory B..... IV-4

FIGURE IV-3
Trajectory C..... IV-5

FIGURE IV-4
Average Oxidant Concentrations From Computer Simulation of June 21, 1973 Episode (ppm), including BAAPCD Measured Oxidant Values at Concord and Pittsburg..... IV-8

FIGURE IV-5
Computer Simulation of 1980 Oxidant Concentrations (ppm), Trajectory A. Proposed Dow Complex Not Included..... IV-9

FIGURE IV-6
Computer Simulation of 1980 Oxidant Concentrations (ppm), Trajectory A. Dow Emissions from Proposed Pittsburg Expansion Included..... IV-10

FIGURE IV-7
Computer Simulation of 1980 Oxidant Concentrations (ppm), Trajectory B. Proposed Dow Complex Not Included..... IV-11

FIGURE IV-8
Computer Simulation of 1980 Oxidant Concentrations (ppm), Trajectory B. Emissions From Proposed Montezuma Plant Included..... IV-12

FIGURE IV-9
Computer Simulation of 1980 SO_x Concentrations (ppm), Trajectory C. Proposed Dow Complex Not Included..... IV-13

FIGURE IV-10
Computer Simulation of 1980 One Hour SO_x Concentrations (ppm), Trajectory C. Emission From Proposed Dow Complex at Montezuma Included..... IV-14

FIGURE IV-11
Calculated One Hour SO_x Concentrations (ppm),
Proposed Montezuma Plant..... IV-15

FIGURE IV-12
Calculated One Hour NO_x Concentrations (ppm),
Proposed Pittsburg Plant..... IV-16

FIGURE V-1
Montezuma Water System..... V-2

FIGURE V-2
Diversion-Discharge System Montezuma Site..... V-3

FIGURE V-3
Range of Relationship Between Delta Outflow
and Chlorosity at Chipps Island..... V-8

FIGURE V-4
Water Quality Data Summary..... V-11

FIGURE V-5
Montezuma Site Plan..... V-20

FIGURE VII-1
Land Use Plan..... VII-6

FIGURE XI-1
Diagrammatic Plan of Deep Draft Bulk Port
at Collinsville, California..... XI-19

FIGURE XII-1
Plant Layout, Geology, and Topography-Pittsburg Site..... XII-2

FIGURE XII-2
Plant Layout, Geology, and Topography-Montezuma Site..... XII-3

FIGURE XIII-1
Topographic Features of Project Area..... XIII-2

PREFACE

The Dow Chemical Company is planning an expansion of its Pittsburg petrochemical complex in Contra Costa County. The new facilities include an expansion of its existing facility near Pittsburg, additional facilities at a new site in the Montezuma Hills of Solano County east of Collinsville, and four pipelines connecting the two sites.

These facilities would produce plastic raw materials to supply a portion of the existing demand for such products in the United States west of the Rocky Mountains. The project is in the planning phase and applications have been filed for a variety of permits and approvals. Actions by State and local agencies require compliance with the California Environmental Quality Act of 1970 which requires the preparation of an environmental impact report. The Draft Environmental Impact Report, which was completed for the Dow Project in August of 1975, describes the project as well as the environmental and economic effects of the proposed facilities.

In accordance with the guidelines for implementation of the California Environmental Quality Act of 1970, the Draft EIR was filed with the State Clearinghouse on August 8. The State review period was extended to September 10 at the request of the Department of Fish and Game. The State EIR Monitor Issues of August 11 and August 25 contained notices of the project. Both Solano and Contra Costa Counties also conducted formal review periods on the Draft EIR. Contra Costa County held public hearings on September 2 and September 16 and held the period for written comments open until September 19, 1975. Solano County held public hearings on September 4 and September 18 and extended the period for written comments until September 30, 1975. During the review period which lasted 53 days, over 500 copies of the Draft EIR were distributed by the two counties, the Clearinghouse, and The Dow Chemical Company. Extensive comments on the Draft were received from Federal, State, and local governments as well as private groups and individuals.

Section 15146 of the Guidelines specifies the contents of the Final Environmental Impact Report. In accordance with those guidelines, the Final EIR for the Dow Petrochemical Project consists of the August 1975 Draft Environmental Impact Report and:

- A summary of all comments received on the Draft.
- A list of persons commenting on the Draft.
- Detailed responses to the comments.

These items are included in this supplemental report.

Editorial changes shown on the Errata dated October 16, 1975, have been included in this publication.

Introduction 1

CHAPTER I

INTRODUCTION

This supplement contains responses and comments made during the review process on the August 1975 Draft Environmental Impact Report for the Dow Petrochemical Project. The purpose of the responses is to supplement the information contained in the Draft EIR which should be used as the basic resource document for information regarding the project and environmental and economic conditions. The purpose of the Final EIR is to provide sufficient information so that local and State regulatory bodies can understand the full effect of their actions.

The project will be constructed over a period of five to seven years. Initial operations of part of the Solano complex are not expected until 1978. Full operation is not expected before 1982. During that time, detailed facility designs will be finalized, permit conditions established, and legislative environmental and economic goals will be altered. Thus, this EIR should be viewed as it relates to near-term decisions such as rezoning and Williamson Act cancellation. However, it is also likely that many of the permits and future changes will result in the need to provide regulatory agencies with additional information as permits are considered.

The degree of investigative detail and specific conclusions in this EIR falls into the following three categories:

- Background Information. The basic background information on air, water, soil, seismic, climatic, zoning, and environmental characteristics should provide the maximum amount of available information so that the impact of the Dow project as a whole, both short-term and long-term, can be evaluated.

- Project Impacts. The direct impacts of the project during construction and operational phases must be quantified to the limits of existing knowledge considering the status of design and uncertainty regarding future regulatory criteria.

- Induced Growth Impacts. This assessment must be in sufficient detail to determine the long-range implications of near-term actions on the Dow project. It is reasonable to hypothesize employment resulting from induced growth and its impacts. However, attempts to project effects such as air quality of other potentially adjacent industries of unknown size, complexity and function, could be grossly misleading. This is particularly true in the face of improving technology and changes in regulatory requirements which will apply to all projects.

Because of the size, location, and character of the Dow facilities, they will require an extensive number of permits. Recent estimates are between 60 and 70. Each permitting agency will and has required specific additional detailed information to comply with its regulations. The project's designers will undertake additional technical analysis continuously during the next two years. The results of established permits for air emissions, currently the subject of debate between the State and the Bay Area Air Pollution Control District and the requirements of the Regional Water Quality Control Board with regard to an acceptable spill prevention plan are but two of the actions requiring significant additional work. Therefore, it would appear unrealistic to delay completion of the EIR pending an agreement by all agencies on all aspects of the project. For instance, the NPDES permit for waste discharge has recently been issued by the Regional Water Quality Control Board.

Decisions on the Dow project basically fall into two categories. The first is the general policy decision of Solano County to allow industrial development after consideration of possible environmental, economic, and social impacts. The second are individual permits which are issued by regulatory agencies, primarily designed to provide for safety and environmental protection. A project applicant proceeds at his own risk making his best judgment of the likelihood of securing permits and the appropriate terms. Since many environmental requirements are technology based, subsequent applicants for industrial uses in the Southeastern Solano County may have more difficulty in securing permits that would result in economical operation.

Commentors on the Draft EIR have emphasized the regional relationships associated with employment, navigation, accidental spills, air and water pollution, and transportation. These regional factors apply to some extent to the Dow project and

particularly to the development of a significant industrial complex in Southeastern Solano County. Many of the long-range economic, environmental, and social problems created by such development can only be solved in the context of detailed County-regional planning. Many of the commentors have requested the resolution of these issues as part of the EIR and in some cases as additional studies. Where it is obvious that such studies should begin, they have been identified as mitigation measures for each response and summarized in the summary of mitigation measures.

Summary of Comments II

CHAPTER II

SUMMARY OF COMMENTS

FEDERAL AGENCIES

U. S. Army Corps of Engineers

Letter from G. W. Probasco, Chief, Construction-Operations Divisions, to Director, Solano County Planning Department, dated September 18, 1975.

The description of the proposed dock should be expanded to give a better indication of its size. Also, due to the fact that significant adverse ecological impacts could result from the accidental spill of petroleum products, Dow's spill protection contingency plan should be included. The report should clarify that a replacement dredged material disposal area will be provided at no cost for use by the Corps of Engineers at a location acceptable to the Corps. A location or alternative locations and size should be described together with pertinent environmental characteristics and impacts anticipated.

The description of the turning basin to be dredged and the impacts associated with this should be clarified and expanded. The economic efficiency of using larger ships to serve the proposed petrochemical plant should be stated and the effects on the current feasibility study (Sacramento Deep Water Ship Channel) should be discussed.

Other minor editorial comments were also included.

United States Coast Guard

Letter from Lieutenant Commander E. G. O'Keefe, Chief, Marine Environmental Protection Branch, to Michael J. Harrold, Chief, Current Planning Division, Solano County, dated September 10, 1975.

Preliminary comments have been sent to the Commandant in Washington for further comment. Therefore, a 30-day extension of time in which to comment is requested.

Department of the Air Force

Letter from Colonel James T. Rock, Base Commander, Travis Air Force Base, to Clayne E. Munk, Planning Director, Solano County Planning Department, dated September 10, 1975.

No objections were found in the Draft EIR.

STATE AGENCIES

The Resources Agency

Memorandum from L. Frank Goodson, Office of the Secretary, to Preble Stolz, Director, Office of Planning and Research, dated September 11, 1975.

The Agency expresses a special concern for two major areas of inadequacy:

1. The EIR does not consider the impact of a major petrochemical facility located in the San Francisco Bay Area on the transportation of crude oil from offshore California production, particularly in the Santa Barbara Channel.

2. The Final EIR must include geologic and engineering assurances that no major spills will occur to the waters of the Sacramento-San Joaquin Delta. In addition, the location of the northern extension of the Antioch Fault where it crosses the Sacramento and San Joaquin Rivers must be accurately determined.

Department of Food and Agriculture

Memorandum from Robert M. Pratt, Special Assistant, Environment, to Office of Planning and Research dated August 18, 1975.

1. Zoning--Since the proposed Montezuma site is in an area of very limited land access, the EIR should state whether or not Caltrans has adopted the proposed freeways. In addition, the project's impact without the freeways should be discussed in greater detail.

2. Williamson Act Contract Cancellation--The EIR must state if and how the project can be considered consistent with the policies of the Williamson Act. The EIR fails to show that the land is uneconomical to farm and should present net profit or loss figures to make a convincing argument.

3. Continued Agricultural Production--The EIR should specify with clarity exactly how much land is to be kept in agriculture, for how long, and what is the ultimate intended use of the remainder of the property.

4. Growth-Inducing Impact--The EIR should more precisely comment on the effects this project would have on adjacent users as a result of cumulative unplanned development. For instance, the workers would probably desire to live closer to work and would move from the Fairfield and Rio Vista areas to residential developments on agricultural lands within five or ten miles of their place of work.

5. Site Alternatives--The EIR is not complete without a discussion of sites in the Collinsville area, which is already industrially zoned and has better transportation facilities than the proposed site.

State Water Resources Control Board

Memorandum from Thomas E. Bailey, Acting Chief, Division of Planning and Research, to L. Frank Goodson, Projects Coordinator, The Resources Agency, dated September 4, 1975.

1. Water Supply--The discrepancy in the application to store water (2,600 acre-feet annually) and the capacity of the reservoir described in the EIR (1,700 acre-feet) must be explained.

2. Water Quality--It would be informative to give quantitative estimates of the salinity increases, particularly for critical low flow conditions (2,500 cfs).

   The Regional Board should be consulted prior to completion of the Final EIR.

The Final EIR should contain a more specific plan for disposal of Group I wastes.

The Final EIR should include estimates of the maximum, average, and minimum expected volumes of potential spills resulting from individual transportation, storage, and handling events, and predictions of dispersion considering drainage patterns intercepted by the railroad and highway to the plant, drainage from the plant property, river flow and tidal stage, time of year, and wind action.

The Final EIR should also include better information on toxicity of products which may be spilled and should include consideration of all important plant and animal populations which may be affected by the spill. In addition, the discussion on spill prevention should be expanded to allow an evaluation of its adequacy.

3. General--The potential effect of the project on drainage affecting marshlands and marsh management options should be considered in the Final EIR.

Air Resources Board

Memorandum from William C. Lockett, Chief, Evaluation and Planning, to Ken Fellows, Department of Water Resources, dated August 19, 1975.

The EIR presents a comprehensive analysis of the air quality impact of the proposed project. However, The Dow Chemical Company must demonstrate to the Bay Area Air Pollution Control Officer that its stationary source will not cause any air quality standard to be exceeded beyond the limits of its property before he can issue a permit to operate.

The Reclamation Board

Memorandum from P. C. Walters, Chief Engineer and General Manager, to Claire T. Dedrick, Secretary for Resources, dated August 22, 1975.

The EIR would be improved by the addition of an adequate map showing the relationship of the Montezuma plant, the Pittsburg plant, and the pipelines connecting the sites.

State Solid Waste Management Board

Memorandum from Albert A. Marino, Executive Officer, to Claire T. Dedrick, Secretary for Resources, dated August 26, 1975.

1. The Final EIR should address more specifically the topics of Group I waste generation and disposal, indicating waste composition and quantities, and arrangements for their proper disposal.

2. The spill contingency plan should be expanded to include a discussion of disposal of wastes generated in the clean-up activities.

Department of Water Resources

Written comments on SCH #75081230 Notice of Intent by James L. Welsh, Statewide Planning Branch, dated September 10, 1975.

The diversion of 9 to 20 cfs of fresh water from the Western Delta has an environmental impact which the EIR has not addressed. Neither has it discussed the alternative to, or mitigation of, this impact by using some other source of water for processing and cooling such as reclaimed wastewater from the Central Contra Costa Sanitary District.

General and specific comments relate to compatability of Dow water use with State Water Project, its operation, future Delta facilities, and general conditions in the Delta.

Department of Fish and Game

Memorandum from James S. Leiby to Claire T. Dedrick, Secretary for Resources, dated September 10, 1975.

The following comments should be incorporated in the Final EIR:

Wildlife Considerations

1. Existing and potential wetlands should be dedicated to wildlife.

2. Riparian marshland habitat fronting the river should be protected by a setback of 1,000 feet. No artificial bulkheads should be constructed on the shoreline.

3. The "Impacts" section should more clearly define and quantify the loss of habitat that would result from construction and operation.

4. The Final EIR should specify which mitigation alternative (freshwater marsh, brackish-water marsh, no marsh, other) that Dow has selected and discuss the resulting impacts.

5. The EIR should recognize the potential hazard to wildlife due to the evaporation ponds and the presence of toxic or feather-fouling substances.

6. The "Mitigation" section should include a statement that all project-acquired lands other than those needed for physical facilities will, for the life of the project, be maintained as agricultural lands, swales, marshes, or upland wildlife habitat.

7. The wildlife habitat losses associated with pipeline construction should be included in "Unavoidable Effects." In addition, the EIR should contain a positive statement that the pipelines across Sherman Island will closely parallel the existing Dow pipeline.

8. The "Mitigation" section should include a discussion of blasting potholes for wildlife enhancement on Sherman Island.

Fishlife and Water Quality Considerations

1. Although the total amount of fresh water to be diverted from the Sacramento River (≈8 cfs) would not have an appreciable effect on Delta outflow, the EIR should more clearly define the location and amount of diversions.

2. The EIR should discuss the general design of the diversion structure and possible need of a fish screen.

3. The EIR should identify possible or anticipated toxic substances which could appear in plant runoff.

4. A description (location, length, and size) of the proposed dock should be included in the Final EIR.

Division of Mines and Geology

Memorandum from James E. Slosson, State Geologist, to L. Frank Goodson, Projects Coordinator, The Resources Agency, dated September 11, 1975.

The geologic, seismic, and earthquake engineering sections of the EIR are very inadequate for a facility of this type located in such a critical geologic environment. The geologic/seismic analysis should at least meet the minimum contents of the Division's Note 37, "Guidelines for Geologic/ Seismic Reports" (1973) and should be accompanied by a geologic map.

The earthquake engineering section should include reference to the design criteria based on the geologic/seismic data.

Memorandum from John W. Williams, Geologist, San Francisco District Office, to Paul Cox, Program Development Officer, Department of Conservation, dated August 22, 1975.

Further consideration must be given to the possible ground accelerations at the two sites that could be generated by large magnitude earthquakes. The accelerations must be calculated for both bedrock and filled areas.

The activity of the three faults adjacent to the Montezuma site must be more clearly defined. In addition, the location of the northern extension of the Antioch fault where it crosses the Sacramento and San Joaquin Rivers must be accurately determined.

California Coastal Zone Conservation Commission

Written comments on SCH #75081230 Notice of Intent by Frank Broadhead dated September 10, 1975.

The EIR does not consider the impact of a major petrochemical industry located in the San Francisco Bay Area on the transportation of crude oil from offshore California production, particularly in the Santa Barbara Channel.

San Francisco Bay Conservation
and Development Commission

Letter from Alan R. Pendleton, Staff Counsel, to Mr. Clayne E. Munk, Planning Director, Solano County Planning Department, dated September 11, 1975.

The staff of the Commission expressed the following concerns:

1. Chemical Spills and Water Quality--There is almost no discussion of the specific impacts that could occur if spills of the various products being shipped were to happen. The Final EIR should include a discussion of possible impacts of at least the following chemicals which would be transported: 1) chloroethylenes, 2) chlorine, 3) styrene, and 4) caustic. In addition, the specific prevention plan should be fully discussed in the Final EIR.

2. Pipelines--The task of constructing a buried pipeline across the tidal marsh on Sherman Island is not described in sufficient detail. In addition, it is not possible to know where the pipelines will cross the Antioch Fault due to lack of adequate diagrams. It is also unclear whether the pipelines would be able to withstand a major earthquake such as the Antioch Fault is capable of causing.

3. Dredging--A much more detailed discussion of exact plans for dredging procedures would be necessary to adequately evaluate the impacts.

4. Specific Impact on Suisun Marsh--A more complete description in the Final EIR on the impacts of spills, dredging, and possible erosion should be mentioned in the specific context of the Marsh.

5. Air Pollution--The Final EIR should answer the question: How will the proposed plant's emissions affect the pollution capacity of the airshed?

6. Relation to Other Facilities--Not fully discussed is the relationship of the proposed plant to Bay Area refineries and similar proposed petrochemical facilities (i.e., ARCO). It's also necessary to discuss the relationship of the proposed plant to increased shipping in the Santa Barbara Channel.

7. Growth-Inducing Impact--Chapter XI of the report should include a discussion of whether the project and associated facilities would increase the likelihood that the proposed Baldwin Ship Channel would be built.

Letter from Jeffry S. Blanchfield, Senior Planner, to Clayne E. Munk, Director of Planning, Solano County Planning Department, dated September 11, 1975.

Mr. Blanchfield's letter raised the exact same issues as Mr. Pendleton's with respect to: chemical spills, pipelines, dredging, specific impact on Suisun Marsh, and air pollution.

Caltrans, District 4

Written comments on SCH #75081230 Notice of Intent by M. E. Hardin, Deputy District Director, dated September 5, 1975.

The EIR should contain data on peak hour traffic volumes to be generated by the project and an evaluation of the impact of such traffic on the various affected portions of the traffic circulation system, including State highways. The necessary mitigation should also be included keeping in mind Caltrans' decreasing revenue and increasing construction costs.

The proposed freeway shown on Figure III-4 does not correspond to any State highway route and the State has no plans for such development. Figure III-6 omits the Loveridge Road and Somersville Road interchanges and incorrectly shows an interchange at the west city limits of Antioch. Also, up to date traffic data should be shown for Loveridge Road.

Department of Health

Memorandum from Kenneth Buell, Manager, Environmental Health Services Branch, to William G. Kirkham, Management Systems Officer, State Clearinghouse, dated September 12, 1975.

In general, the document appears to oversimplify or to minimize many important points in view of the complexity of the project. Examples are: the specific impact and interaction of the regulations of the proposed project should be addressed; the potential impacts of the plant's emissions

are not adequately discussed; water quality and chemical waste impacts are not spelled out adequately, neither are the potential impacts of shipping accidents; and the potential impact of spilling the various chemical products to be shipped should also be addressed.

The general nature, volume, and composition of the wastewaters to be discharged to the evaporation ponds should be outlined. More detail is also needed on the expected composition, volumes, and final disposal point of the "evaporated material" from the ponds. Mitigation measures to be followed to minimize air pollution from the evaporation ponds should also be included.

The spill contingency plan should include procedures for the safe handling and disposal of spilled chemicals. In addition, the State Department of Health regulations, Title 22, Division 4, Chapter 1, of the California Administrative Code, which cover the handling and disposal of hazardous wastes, should be addressed.

REGIONAL AGENCIES

Bay Area Sewage Services Agency

Letter from Paul C. Soltow, Jr., General Manager, to Michael J. Harrold, Solano County Planning Department, dated September 8, 1975.

Due to the complex nature of the water system, a graphical representation ("water balance") of the system should be included in the Final EIR.

Association of Bay Area Governments

Letter from Mr. Revan A. F. Tranter, Executive Director, to Clayne E. Munk, Planning Director, Solano County, dated September 17, 1975. ABAG's staff comments follow:

1. The project's direct effect should be presented in greater detail.

2. Long-Range Impacts--The EIR should propose ways to ensure that information will be available as the project progresses to assure that long-range planning can proceed.

3. Association Policies--The EIR is deficient in that Association policies are not referenced.

4. Secondary Effects--Substantiate the claim that ancillary industries are far more likely to locate in Contra Costa County. What would be the effects of the proposed Alaskan natural gas pipeline on the Dow complex and what is the additional inducement for growth that would result from this facility. What steps are being taken to assure that the facilities and services will be adequate to accommodate growth?

5. Consistency with Local Plans--Provide information on compatibility of continued agricultural activity with this development.

6. Economic Development--The advantages of the Pittsburg alternative with regard to people resources was not noted.

7. Transportation--Was the proposed bridge across the Sacramento River to accommodate Highway 113 considered an element of the transportation system? Post-construction transportation information was not provided. The Draft EIR does not specify the transportation improvements that will be required and who will be responsible for their construction and does not indicate whether the developer or the County of Solano would undertake the development of the transportation corridor, presumably the improvement of the Collinsville Road.

8. Fiscal Impacts--The Draft EIR has no detail of local service costs, particularly with regard to transportation.

9. Air Quality--There is no analysis of the project's potential effects on ambient air quality, which information is critical to basinwide analysis, the impact of exotic pollutants has not been addressed, and the report should include information on the probability of accidental gas release including spills of chlorine.

10. Water Quality--Clarify how much river water will actually be consumed and what is the cumulative effect of such usage on the estuary. Describe the pipeline crossing with more detail. Substantiate the contention that

resuspension of sediments will not cause a threat to aquatic life. Discuss these effects with regard to maintenance strategy. Give full consideration to the cumulative effects of earthmoving. Clarify the situation with regard to NPDES permit conditions.

Bay Area Air Pollution Control District

Letter from Milton Feldstein, Deputy Air Pollution Control Officer, to Solano County Planning Department dated September 16, 1975.

The air quality impact analysis is deficient in failing to relate emissions to ambient air quality concentrations and in failing to relate such concentrations to ambient air quality standards. The Draft EIR does not provide the reader with any real analysis of the air quality impact of this major project as the reader is not presented with an informed judgment as to the effect those emissions may have on air pollution levels or on the number of excesses of air quality standards, both locally and over a wider geographical area.

The Draft EIR should also provide, at least, an informed qualitative discussion of the air quality impacts of induced growth that might be attributed to the Dow Montezuma facility.

Yolo-Solano Air Pollution Control District

Letter from James A. Koslow, Air Pollution Control Officer, to Clayne E. Munk, Planning Director, Solano County, dated September 24, 1975.

Air pollution impacts are covered in the EIR and it appears that the project would fit into an acceptable air quality framework.

COUNTY AGENCIES

City and County of San Francisco

Letter from Selina Bendix, PhD, Environmental Review Officer, Department of City Planning, to Mr. Clayne E. Munk, Planning Director, Solano County, dated September 26, 1975.

The impact of greatest concern to San Francisco is the increase in shipping with an associated increased risk of shipping accidents. The discussion of shipping accidents is inadequate as the following questions are left unanswered:

1. What is the increase in shipping through the Golden Gate?

2. What is the increase in tonnage of hazardous cargo moving through the Golden Gate?

3. What is the increase in tonnage of hazardous cargo moving over the Bay?

4. What is the change in size distribution of ships passing through the Golden Gate and over the Bay?

5. What is the increase in collision probabilities? (This is not a straight line relationship vs total number of ships.)

6. Why does page V-30 speak of 161 ships per year while page V-50 says 166?

7. Neither this section nor the "Aquatic Life" section on page V-24 discusses the potential impact of shipping accidents involving cargoes of toxic chemicals on Bay Area fisheries.

What would be the effect of the reverse osmosis units on the heavy metal and chlorinated hydrocarbon levels in the Sacramento River which are already higher than the water quality objectives recommended in the State Water Resources Control Board's Water Quality Control Plan for the area?

Have there been any problems in achieving compliance with air and water pollution control standards at the Pittsburg plant? Have there been any citations or cease and desist orders? Are these applicable variances? How many "upset and breakdown" incidents have there been? This information would have some predictive value for the future.

The social and economic impacts discussion does not deal with any of the impacts of the products of the proposed facilities. Will this plant result in an increase in the

content of plastics in California solid wastes? Should this be taken into account in the county solid waste management plans now being finalized in California?

The "Occupation Hazards" section does not, in fact, discuss occupational hazards but the mitigation thereof, and belongs in the Mitigation chapter. What would be the occupational hazards? Both the problems associated with organics and chlorine should be discussed. Proposed manufacture of the known human carcinogen vinyl chloride is of some concern. The hazards of this substance do not appear to be mentioned in this document. The nature of measures to assure that vinyl chloride will not be released, even accidentally, should be of some concern to local health jurisdictions.

The potential use of geothermal power is mentioned at several points in this EIR (page VII-4, etc.) but at no point is there a discussion of the environmental impacts of geothermal power development. Will there be high boron water to dispose of? How will this be done so as not to affect agriculture or native vegetation, as plants are very sensitive to boron level in water?

Chapter VIII does not contain an adequate range of alternatives. Why is the facility being built at this particular size? What would be the consequences if it were larger or smaller? What would be the effect of an alternate mix of products on air and water pollution, occupational hazards, water and energy consumption, waste production, etc.?

County of Sacramento

Letter from Robert J. McKechnie, Environmental Coordinator, to Michael J. Harrold, Solano County Planning Department, dated September 10, 1975.

1. The report does not offer any mitigation measures which would reduce the potential of shipping accidents.

2. There is a need for an assessment of the contribution of the project to background air pollutant levels in downwind areas.

3. The report does not discuss the planned bike trail on Highway 160 in Sacramento County.

4. The EIR does not contain a plate or route description for the proposed pipeline crossing.

Solano County Sheriff's Department

Letter from Albert M. Cardoza, Sheriff, to Clayne E. Munk, Planning Director, dated September 10, 1975.

Sheriff Cardoza suggested that Dow's security staff and his department should plan to coordinate for the expeditious handling of any enforcement problems.

Contra Costa County Flood Control and Water Conservation District

Letter from T. E. Burlingame, Assistant Public Works Director, Flood Control Planning, to Anthony A. Dehaesus, Director of Planning, Contra Costa County, dated September 3, 1975.

1. The proposed improvements in Kirker Creek should be covered in greater detail.

2. The condition of any levees that protect the site should be covered in the report.

3. The report should discuss the affect of the waves created by the additional ship traffic on existing or proposed levees.

Solano County Department of Public Health

Letter from Albert T. Vervais, R.S., Director of Environmental Health, to Solano County Planning Commission dated September 30, 1975.

While we have no objections to the proposal, we do have questions as regards certain aspects of the project.

1. Precautions should be taken to insure that all OSHA requirements with respect to noise are adhered to.

2. There shall be an approved waste disposal area set aside for the project. This area shall be a fenced-in location constructed of basolite block or cyclone fencing with hot and cold running water for washing equipment. It shall also be equipped with a floor drain which shall be connected to the sewerage system.

3. We should like specific information concerning the wastewater disposal system.

4. We would like more information concerning the potable water supply.

5. Will there be persons completely responsible for an occupational health program working for Dow?

CITIES

City of Fairfield

Letter from Dr. Michael Hancock, Chairman, Fairfield Planning Commission, to Mr. Munk, Solano County Planning Department, dated September 11, 1975.

1. Air Quality--Since the project has the potential for significant degradation of air quality, it is recommended that the guidelines of the BAAPCD should be followed in the air quality impact analysis.

2. Transportation--The EIR should precisely locate the transportation facilities and further evaluate the impact on the existing transportation system.

3. Utilities--A more thorough description of how the project site will be supplied with utilities (water, sewer, power, etc.) must be included in the EIR.

4. Social-Economic Impact--The EIR should present sufficient information upon which the social-economic impacts (housing, services, etc.) to Fairfield can be more adequately measured than the present report does.

5. Growth-Inducing--That impact that growth will have upon Fairfield and the future land use patterns projected for the Central Solano County Planning Area must be carefully studied now and evaluated in this EIR.

City of Antioch

Letter from Thomas W. Oglesby, City Manager, to Jack Jones, Manager, Government and Community Relations, The Dow Chemical Company, dated August 22, 1975.

There did not appear to be any discussion regarding the impact of increased population resulting from the project particularly as it would affect the nearby cities and school districts.

City of Rio Vista

Letter from George E. Alphin, City Administrator, to Clayne E. Munk, Director, Solano County Planning Department, dated September 12, 1975.

No comments on the Draft EIR.

City of Vacaville

Letter from Donald R. Foster, Planning Director, to Clayne Munk, Director, Solano County Planning Department, dated September 29, 1975.

The following long-range issues should have been explored: To what extent will the Dow facility be a harbinger of industrial movement from existing areas to regions not yet given over to urban and industrial uses? Will the ultimate industrial development of the Collinsville area generate the demand for new population concentrations in the Rio Vista area? Will the industrial development of the Collinsville area result in a decreased potential for the industrial lands now planned for other parts of Solano County? More specifically, will a movement of industry toward the southeast occur to the detriment of Vacaville's planned industrial reserve?

Antioch Chamber of Commerce

Oral presentation at the September 2, 1975, Contra Costa County Planning Commission's Public Hearing by Mr. Richard Fowler, President.

Whole-heartedly endorse the project.

Rio Vista Chamber of Commerce

Oral presentation at the September 4, 1975, Solano County Planning Commission's Public Hearing by Wayne Gohl, Director.

> Local people in Rio Vista are enthusiastic for the project and believe that an extension of the review period would only create scheduling problems.

Oral presentation at the September 18, 1975, Solano County Planning Commission's Public Hearing by Perry Wilson, President.

> With the advent of new industrial development in the area, perhaps the City of Rio Vista can grow and the economic picture for residents will be better.

LOCAL AGENCIES

Suisun Resource Conservation District

Letter from Glenn I. Wilcox, Soil Conservationist, U. S. Soil Conservation Service, to Solano County Planning Department, dated September 2, 1975.

1. Specific provisions should be included in the Final EIR to provide temporary erosion control on nonutilized areas until construction and final landscaping is complete.

2. The water quality control and solar evaporation facilities are proposed for an area presently encumbered by a USCE dredge spoil easement. The report does not reveal how this conflict would be resolved.

3. The report does not state where the 45,000 cubic yards of annual maintenance dredging spoils will be placed after facilities are constructed on the lower plain.

4. The "Mitigation" section should include measures to discourage use of the evaporation ponds by wildlife.

Contra Costa County Development Association

Oral presentation at the September 2, 1975, Contra Costa County Planning Commission's Public Hearing by Mr. Paul F. Hughey.

Strongly endorses the project.

Solano County Industrial Development Agency

Oral presentations at the September 4, and September 18, 1975, Solano County Planning Commission's Public Hearings by Ron Henrekin, Director.

Requested that the Planning Commission consider the economic advantages of the Dow petrochemical project as well as the environmental aspects.

Solano County Taxpayers' Association

Oral presentation at the September 18, 1975, Solano County Planning Commission's Public Hearing by Jim Hopkins.

Recommended approval of the Draft EIR and the proposed project.

Port of Sacramento

Letter from Melvin Shore, Port Director, to Planning Director, Solano County, dated September 8, 1975.

No comments on the Draft EIR.

Napa-Solano Counties Building and Construction Trades Council

Letter from Joseph Valdez, President, to Solano County Planning Commission dated September 30, 1975.

Having taken all things into consideration, we the representatives of organized labor in Napa and Solano Counties pray that the Board members of the Solano County Planning Commission will look favorably upon the permits to be issued to The Dow Chemical Company in order that this project may proceed.

ENVIRONMENTAL GROUPS

Sierra Club, Bay Chapter

Oral statement at the September 16, 1975, Contra Costa County Planning Commission's Public Hearing by Harry Reeves.

The problems of related and dependent industries who would be servicing or dealing with products produced by Dow should be given more attention. For example, what affect does this project have on the Baldwin Ship Channel.

There is no specific breakdown or evidence as to the number of people that actually could be employed out of Contra Costa except in a very general way.

The report does not deal with the basic question "what's the best use of our petroleum reserves (i.e., should we use petroleum to make throw-away plastics)?" Because of these concerns, a 30-day extension for written commentary is requested.

Sierra Club, Redwood Chapter

Oral presentation at the September 4, 1975, Solano County Planning Commission's Public Hearing by Cynthia Kay, Conservation Chairman, Solano County Group.

1. The EIR only addresses the Southeastern Solano County Planning Area's General Plan 1990 and almost totally ignores the rest of Solano County.

2. Hazardous spills of highly flammable and toxic products should be covered in more detail.

3. Seismic hazards created by four high pressure pipelines crossing the active Antioch Fault require additional study.

4. Impacts on wildlife and birds need more review.

5. Questions must be answered concerning the adequacy of water supplies, the effect of large withdrawals on the Bay-Delta system, and the impact of any discharges on the system.

Letter from Cynthia Kay, Solano Group Conservation Chairman, to Clayne Munk, Solano County Planning Director, dated September 12, 1975.

1. Air Quality--The true nature of the air quality impact can only be made evident through the use of relevant data and accepted calculation techniques. Therefore, "Guidelines for Air Quality Impact Analysis of Projects" prepared by the BAAPCD should be followed. The results should enable a ready comparison of project-related pollutant concentrations with applicable air quality standards.

2. Products--The EIR does not explain where the chloro-ethylene and propylene oxide pipelines would terminate (Figure 2).

3. Shipping--Would super tankers be used?

4. Pipeline Crossings--What would be the impact of a pipeline break on land?

5. Pittsburg Site--Where would the 200,000 cubic yards of imported fill come from?

6. Montezuma Site--Who would pay for transportation corridor and where would the 3 million cubic yards of fill come from?

7. Evaporation Ponds--Could earthquakes or floods damage the ponds? Would migrating waterfowl be affected by the ponds?

8. Water Supply--How many acre-feet per day would be diverted?

9. Wastewater Disposal--What would the daily discharge volume be in acre-feet?

10. Materials--Where would the salt come from and who would supply it?

11. Associated Facilities--There should be a list of fabricators and distributors that would most likely use Dow's products.

12. Fishery--What impact would waste discharge have on the fishery?

13. Wildlife--Are burrowing owls going to be effected?

14. Land Use--Questions the discrepancy between 600 acres for facilities and 1,180 acres to be rezoned. Should expand the secondary land use effects.

15. Aesthetics--How far would localized fogs extend?

16. Spill Prevention--There should be a more detailed discussion of the proposed contingency plan.

17. Growth-Inducement--Who would pay for the infrastructure and would the proposed Solano Irrigation District water supply project be part of the regional water supply?

Sierra Club, Northern California
Regional Conservation Committee

Oral presentation at the September 16, 1975, public hearing of the Contra Costa County Planning Commission by Dick Jordan.

1. There should be a discussion of the project's compatibility with ABAG's Regional Plan: 1970-1990, including its policies.

2. The Draft EIR does not address the question relating to the best allocation of scarce resources (i.e., petroleum).

3. The Draft EIR does not deal comprehensively with the growth-inducing impacts of the project.

4. There is also a need for more discussion relating to:

   a. Air, water, and noise quality criteria
   b. Data source documentation
   c. Biological information
   d. Life expectancy of solid waste disposal sites
   e. Capital requirements of roads and public facilities
   f. Possibility of residential construction
   g. Energy conservation
   h. Compatibility of project with soil/geologic conditions
   i. Impact on pleasure boating
   j. Alternatives

Save San Francisco Bay Association

Oral presentation at the September 16, 1975, public hearing of the Contra Costa County Planning Commission by Steve McAdam.

1. The report does not sufficiently detail how the Sherman Island marshes will be protected.

2. The report inadequately describes the operations and construction along the shorelines (e.g., seismic safety, pier design, depth of Bay Mud, spoils, ship traffic hazards).

3. The report should discuss the demand for fresh water not only for the plant but also for potential residential and industrial growth.

4. The section regarding the impact on water quality does not adequately address the problem.

Davis Audubon Society, Inc.

Letter from Anne Sands, Conservation Committee Chairman, to Michael J. Harrold, Solano County Planning Department, dated September 10, 1975.

1. Much more information should be provided regarding spill prevention.

Environmental Defense Fund

Letter from Thomas J. Graff, Regional Counsel, and Nicholas Acguimbau, Staff Assistant, to Solano County Planning Commission dated September 16, 1975.

> The Draft EIR raises, but answers at best superficially, substantial questions regarding the applicability of the Williamson Act, relevant air and water quality criteria, and recent Suisun Marsh protection legislation. All too little attention has been given to the impact of the project on the Bay Area as a whole, and on the likely consequences of opening an entire new area to industrial development. Therefore, an extension of time for review to October 11, 1975, is deemed necessary.

Letter from Zach Willey, PhD, Staff Scientist, and Nich Acguimbau, Staff Assistant, to Mr. Michael J. Harrold, Solano County Planning Department, dated September 29, 1975.

> The Draft EIR on the Dow plant appears to have been hastily prepared for the purpose, not of asking the serious assessment of environmental costs and benefits which is called for by CEQA, but of "snowing" the public and going through formalities with a minimum of serious effort. The result leaves numerous unanswered questions which should be addressed in the Final EIR, including the following:
>
> 1. Is it wise to commit the San Francisco Bay Area generally, and Solano County particularly, to turning itself into a major processing zone for Alaskan oil, irrevocably changing the character of the region while providing sustained development for less than two decades?
>
> 2. Is the development of major new petrochemical facilities along the Sacramento River consistent with the Sacramento-San Joaquin Delta Master Recreation Plan as revised February 1973? In particular, is it consistent with the recommendations of that Plan to make special efforts to consider recreational values in all development in the region and to protect agriculture in the region from encroaching development?

3. What is the statistically most probable number of tanker collisions to be expected in the Sacramento River due to traffic related to the Dow facility and related development? What are the probable effects of consequent spills on Suisun Marsh and other wetlands?

4. What will be the volume of oil released in the Sacramento River and San Francisco Bay from ballast of tankers associated with the Dow project and related development? What will be the impact of this oil on Suisun Marsh, the Delta generally, the resident and migratory water fowl?

5. What will be the impact of a reduction in the flow of the Sacramento River of 6.5 million gallons per day on salinity downstream and on the availability of water for alternative uses including irrigation and supplies to Southern California?

6. What will be the impact of thermal pollution permitted by the proposed NPDES permit on fish and waterfowl? If it is the intention of Dow to return water to the river at approximately its natural temperature, why has the alternative of issuing a permit making that a requirement not been considered?

7. Will the pipelines to be built between the Montezuma and Pittsburg sites be able to withstand slippage along the Antioch Fault? What safety features must be or will be incorporated for this purpose? What would be the environmental effects of breakage?

8. Why, as alleged in the Draft EIR, is the proposed zone change consistent with the 1990 Land Use and Circulation Plan for Southeastern and Solano County?

9. What impact will the proposed project have on the scenic road indicated in the 1990 Plan on the border of the Suisun Marsh?

10. Why, as alleged in the Draft EIR, is the proposed cancellation of the Williamson Act contract on McOmie Ranch consistent with the purposes of the Act to preserve agricultural land?

11. What alternatives are there to the proposed zone change, such as a zone change on a smaller acreage, an ordinance including setbacks, or an ordinance incorporating safety requirements and stringent effluent limitations?

12. What rare or endangered species could be destroyed if petroleum spills related to the plant were to occur or if increased salinity caused by the plant were to affect downstream wetlands?

13. What will be the effect on air quality as defined by BAAPCD regulations, California's Ambient Air Quality Standards, and Federal Ambient Air Quality Standards of the enormous quantities of sulfur oxides, nitrogen oxides, and hydrocarbons emitted by the proposed plant? Will the plant be able to comply with the law? What studies of air movement and inversion frequency have been done to demonstrate the feasibility of compliance? What will be the effects of increased air pollution on agricultural production and public health in the Solano County and Contra Costa County region?

If serious consideration is given to each of these questions, the Final EIR may begin to approach the "detailed statement" which the law requires.

Northern California Committee for
Environmental Information and Friends
of the Earth, San Francisco Bay Branch

Letter from Ms. Laura Baker to Mr. Jonas, Contra Costa County Planning Department, dated September 18, 1975, plus oral presentations at the September 4, 1975, Solano County Planning Commission's Public Hearing by Ms. Laura Baker, Ms. Barbara DesRochers, and Mr. Bill Voight, and at the September 18, 1975, Solano County Planning Commission's Public Hearing by Mr. Bill Voight, Ms. Barbara DesRochers, and Dr. Richard Garcia.

In general, the EIR is deficient in a number of areas. All too frequently, critical information is omitted shifting the burden of investigation from the consultant to the reader. Emphasis is often misleading in sections where a balanced presentation of facts is required. Trivial and unnecessary data and tables are offered in significant areas, while areas in which real hazards exist are left unanlyzed and unquantified. Without substantial alteration and addition,

this EIR cannot be considered to meet the minimal requirements of CEQA. Furthermore, the very scope and weight of the proposed development make it imperative that adequate time be allowed for a thorough job of review and response. Detailed comments follow.

Summary. The summary lacks any indication that adverse impacts will occur and only includes the supposed economic benefits to Solano and Contra Costa Counties. This bias remains throughout the document. Estimates of the "West Coast Market" for Dow's products are based on an unpublished study and therefore impossible to assess. However, the assumption is made that the West Coast market is an absolute figure rather than that highly flexible price-sensitive figure known as demand.

Project Description. The failure to mention that Alaskan oil reserves will be depleted in about 15 years and therefore the potential for a ghost town effect by the year 2000 is a major flaw and defies the concept of sound and reasonable industrial planning. The discussion of economic savings accrued by locating the plant on the West Coast is misleading and vague--the savings will be for Dow. Graphics lack detail with respect to the pipelines, turning basin, plant locations, transportation corridor, and wildlife areas. There is also question as to whether all sources of water supply have been covered.

A more detailed construction schedule is necessary for the pipelines and dredging to allow the reader to assess the impacts on migrating fish.

Bias toward the social benefit of associated facilities is shown since the industries most likely to locate would be high-polluting industries such as polystyrene, polyethylene, polyvinyl chloride, and rubber manufacturers.

Environmental Setting. The Jennings (1974) reference is not listed in the "List of References." All earthquakes through 1975 should appear in the listing on pages II-17 and II-18. In addition, a verbal communication from PG&E cannot be considered adequate refutation of the existence of a fault.

Water Quality. It is not possible to verify the salinity data given in different sections of the report due to inconsistencies in units (e.g., percent salinity, mg/l, ppm, etc.). The responsibility for clarity should lie with those preparing the report rather than those reading it. Other water quality data are presented without units.

Climate and Meteorological. The statement that "the project sites are in the major passageway for marine air flowing into the Central Valley which is considered advantageous" is wrong. The Central Valley is an effective "trap" for polluted air, thus the location of the Dow plants facilitate Valley pollution. The claim that "adequate ventilation and dispersion of study area emissions" is virtually meaningless without data and documentation.

Unavoidable Adverse Impacts. Many of the chemicals handled or produced at this plant are either flammable, caustic, or carcinogenic; however, little or no information is presented on how these hazardous materials will be prevented from escaping to the immediate and surrounding environment. Specific hazardous chemicals are: benzene, butadiene, phenol, chlorine, and vinyl chloride.

Biotic Environment. Only a cursory list of the flora and fauna of the two areas is mentioned. Why are there no data presented dealing with population levels of the plants and animals? Without such information on actual population levels at various times of the year, how can one accurately assess the potential impact?

Neither the quantification of the solubility of naphtha nor the impact of naphtha upon aquatic forms and marshland vegetation are touched upon. These figures would have direct bearing upon the aquatic organisms in the area of a spill.

The species lists in Appendix G lack quantification and information sources. Numerous species of wildlife were also omitted from the lists--for instance, 5 species of fish, 53 species of birds, and 13 species of reptiles. All of these should be included in a faunal survey.

The text also lacks quantification with respect to benthic forms and other aquatic life.

Mitigation. The report states that dredging will be scheduled to avoid peak movements of anadromous fish. However, different species migrate at various periods of the year. Therefore, a detailed schedule must be presented.

Growth-Inducing Impacts. The industries most likely to locate in the Pittsburg area as a result of Dow's presence are the polyvinyl chloride, rubber, polystyrene, and polyethylene manufactures--all highly polluting industries. The fact that no mention is made of this additional stress on Contra Costa's air resources is a grievous oversight.

In like manner, there is no mention of the fact that the Delta's water supplies can hardly sustain further taxing. Another major omission is any discussion of shipping increases and resultant spills and collisions. No mention is made of the attraction of oil tankers from Santa Barbara offshore rigs that will undoubtedly result as a consequence of refinery expansion in the Bay Area. Furthermore, nothing has been mentioned of what role Dow will play in fostering the creation of the Baldwin Ship Channel.

Once again, the economic benefits to accrue in the form of jobs and tax revenues are highlighted while possible adverse effects are ignored. This section represents a lip service approach to CEQA's requirements.

West Contra Costa Conservation League

Oral presentation at the September 2, 1975, Contra Costa County Planning Commission's Public Hearing by Mrs. Barbara Vincent.

The report does talk about the dangers from increased shipping but it does not dwell upon the fact that in the wintertime it is terribly foggy. In addition, the report does not really address itself to the basic energy needs of the County. For instance, will crude oil be used to make junk plastics?

The weakest part of the report is the section on air quality, especially in the mitigation section. Infrared, in-stack monitoring systems should be included as a mitigation measure and air pollution should be included as an unavoidable environmental impact.

Oral presentation at the September 16, 1975, Contra Costa County Planning Commission's Public Hearing by Mrs. Jean B. Siri.

There are four or five inadequacies with the Draft EIR. The one very real problem is the inadequacy of the treatment of the air pollution problem, especially the problem with lung cancer in Contra Costa County.

The NO_x problem posed by this plant as well as the SO_2 and hydrocarbons are major considerations. The NO_x will certainly add to the mass the people are living through in Livermore, for example. There is no discussion relative to air pollution mitigation measures.

There is no real discussion of spoils disposal either. Dust problems associated with this are not discussed. There is also an inadequate discussion of Group I (hazardous) wastes.

Impacts of the satellite developments are not discussed nor are the impacts of wave action caused by ships on the healthy marsh.

San Pablo Historical Society

Letter from Anna S. Gaumer, Secretary, to Planning Director, Contra Costa County, undated.

1. The report should include an archaeological investigation of Sherman Island.

Solano Citizen Access to Planning

Letter from Michael Garabedian, Director of Research, to Mr. Clayne Munk, Planning Director, Solano County Planning Department, dated September 30, 1975.

Mr. Garabedian's letter contained an attachment of 87 pages of very detailed questions. The majority of the attachment was handwritten and very difficult to read. The major issues raised appeared to be basically the same as those by other commentors although in much more detail. A sample of some of the detailed questions, which referred to specific paragraphs, are:

1. Could not a photo of better quality be used?

2. If Alaska oil is delayed (for example, due to the ice packs which are frequently slowing development of the Prudhoe Bay fields), will there be delay in the project: (a) construction, (b) start of production, (c) type of product output, (d) volume of production, and if so for any of these, which facilities or products would be affected?

3. RE: barger, (a) what capacity, draft, and number per day or week; (b) what existing and future facilities in the San Francisco Bay Area are suppliers and prospective suppliers, and what are their present and projected outputs?

4. What are the (a) locations of other chemical manufacturing companies, and (b) what are their expansion plans?

Oral presentations at the September 4, and September 18, 1975, Solano County Planning Commission's Public Hearing by Michael Garabedian, Director.

Suggested that economic planning take place in a proper democratic manner. The EIR does not cover many social and State planning issues and, therefore, requested another 30 days for review. Two other issues not covered are the longevity of the Alaskan oil supply and the Statewide energy planning issues.

Preservation of Agricultural Lands in Solano

Letter from Charles C. Cook to Solano County Planning Commission dated September 29, 1975.

The potential hazardous possibilities in several areas have not been properly explained. When the issues of the Draft EIR have been adequately answered, we along with everyone else would be pleased with the benefits of an industry like Dow locating in Solano County.

INDIVIDUALS

Ms. Christina Drane

Letter to Clayne E. Munk dated September 8, 1975.

The biological and ecological sections seem to be complete; however, the section on archaeology seems to be vague and incomplete. It is recommended that core samples and other investigative work be carried out on Sherman Island prior to construction.

Mr. Robert B. Hamilton

Letter to Solano County Planning Commission dated September 9, 1975, plus oral presentations at the September 4, 1975, and September 18, 1975, Solano County Planning Commission's Public Hearings.

1. Independent experts should be hired by the Planning Commission.

2. Risk of damage due to oil spills will be increased by the project; when will an accident occur?

3. The report fails to say what would happen to the four pipelines if there were elastic rebound (violent movement on the Antioch Fault).

4. Questions statements in the geologic and seismic sections of the report.

5. The EIR should contain a statement as to where the prevailing winds will direct the air pollutants from the proposed plant including chlorine leaks and odors and discuss growth-inducing effects.

6. What are water and air standards for the area?

7. What will be the effect of withdrawals on groundwater?

8. The possibility of fires in Suisun Marsh caused by careless drivers on Collinsville Road was not covered in the EIR.

9. Who will pay for increased road maintenance costs? More detail on traffic impacts is needed.

10. Adverse effects on growth should be detailed.

11. Will project result in increased taxes and adversely effect schools?

12. What is Dow's program for recycling plastics?

13. Does not agree with the statement on page V-22 that the change in land use would be economically and socially beneficial and slightly detrimental to the agricultural economy due to the limited productivity of the area.

14. What is the land price and can others purchase the land?

15. What will be unemployment when project ends?

16. Approval of this project will result in others.

17. What will be future employment status of construction workers?

Ms. Suzanne R. Bell

Letter to Solano County Director of Planning dated September 10, 1975.

No comments on the EIR.

Mr. Hershel Wingfield

Oral presentation at the September 18, 1975, Solano County Planning Commission's Public Hearing.

Informed the Commission that when the General Plan was prepared there was an industrial area provided for in the area where Dow proposes to construct its new facilities.

Landowners of Collinsville

Oral presentation at the September 18, 1975, Solano County Planning Commission's Public Hearing by Mr. W. Emmington.

> The small landowners in the area against the project as it is not consistent with their interests.

Mr. Dell Hatch

Oral presentation at the September 18, 1975, Solano County Planning Commission's Public Hearing.

> The added tax base would be advantageous for the citizens of Solano County, and there is a definite need for industry to help pay costs of County government.

Ms. Ariel Parkinson

Letter to Solano County Planning Commission dated September 29, 1975.

> A good example of the trickle-down theory of recession therapy follows:
>
> > The Dow Chemical Company may build a $500 million plastics plant near Collinsville that will have 410 permanent employees. That's a million dollar investment per job. This country has enough plastic. It does not have enough jobs for the long-term welfare of the people of Solano County.

Mr. Rich Snowdon

Letter to Mr. Clayne Munk, Director, Solano County Planning Department, dated September 29, 1975.

> Referred to an article published in the "San Francisco Bay Guardian" newspaper dated September 27-October 3, 1975, and requested that the questions and criticisms raised in the article be submitted to Dow and J. B. Gilbert & Associates for their response. In general, that article requested information concerning induced growth, accidental spills, dredging impacts, wildlife, air quality, and water resources.

SUMMARY OF COMMENTS BY MAJOR ISSUE

	Growth Inducement	Air Quality	Water Resources	Hazardous Wastes	Accidental Spills	Transportation	Wildlife and Vegetation	Economic Impact	Williamson Act	Geology, Soils, Seismic	Pipeline	Request Time Extension	No Comments
FEDERAL AGENCIES													
U. S. Army Corps of Engineers		X	X		X	X		X		X	X		
U. S. Coast Guard												X	
Department of the Air Force													X
STATE AGENCIES													
The Resources Agency						X				X	X		
Dept. of Food & Agriculture	X					X			X				
State Water Resources Control Board			X	X	X		X						
Air Resources Board		X											
The Reclamation Board													X
State Solid Waste Management Board				X	X								
Department of Water Resources			X										
Department of Fish & Game			X				X						
Division of Mines and Geology										X	X		
Calif. Coastal Zone Conservation Commission						X							
San Francisco Bay Conservation & Development Commission	X	X	X	X	X	X	X			X	X		
Caltrans, District 4						X							
Department of Health		X		X									
REGIONAL AGENCIES													
Bay Area Sewage Services Agency			X										
Association of Bay Area Governments	X	X	X			X		X	X				
Bay Area Air Pollution Control District	X	X											
Yolo-Solano Air Pollution Control District													X

SUMMARY OF COMMENTS BY MAJOR ISSUE (cont'd)

	Growth Inducement	Air Quality	Water Resources	Hazardous Wastes	Accidental Spills	Transportation	Wildlife and Vegetation	Economic Impact	Williamson Act	Geology, Soils, Seismic	Pipeline	Request Time Extension	No Comment
COUNTY AGENCIES													
City & County of San Francisco					X	X	X					X	
Sacramento County		X			X	X							
Solano County Sheriff													X
Contra Costa County Flood Control & Water Conservation District					X								
Solano County Department of Health			X	X									
CITIES													
City of Fairfield	X	X	X			X		X					
City of Antioch	X												
City of Rio Vista													X
City of Vacaville	X							X					
Antioch Chamber of Commerce													X
Rio Vista Chamber of Commerce													X
LOCAL AGENCIES													
Suisun Resource Conservation District			X				X						
Contra Costa County Development Association													X
Solano County Industrial Development Agency								X					
Solano County Taxpayers Association													X
Port of Sacramento													X
Napa-Solano Counties Building & Const. Trades Council								X					

SUMMARY OF COMMENTS BY MAJOR ISSUE (cont'd)

	Growth Inducement	Air Quality	Water Resources	Hazardous Wastes	Accidental Spills	Transportation	Wildlife and Vegetation	Economic Impact	Williamson Act	Geology, Soils, Seismic	Pipeline	Request Time Extension	No Comment
ENVIRONMENTAL GROUPS													
Sierra Club, Bay Chapter	X					X						X	
Sierra Club, Redwood Chapter	X	X	X		X		X			X	X	X	
Sierra Club, Northern Calif. Regional Conservation Committee	X	X	X	X			X			X	X	X	
Save San Francisco Bay Assoc.			X				X						
Davis Audubon Society, Inc.					X								
Environmental Defense Fund	X	X	X		X		X		X			X	
Friends of the Earth	X	X	X		X		X	X		X	X	X	
Northern California Committee for Environmental Information	X	X	X		X		X	X		X	X	X	
West Contra Costa Conservation League		X			X								
San Pablo Historical Society													X
Solano Citizen Access to Planning												X	
Preservation of Agricultural Lands in Solano								X					
INDIVIDUALS													
Christina Drane													X
Robert B. Hamilton	X	X	X		X	X		X	X	X	X	X	
Suzanne R. Bell													X
Hershel Wingfield													X
Landowners of Collinsville	X												
Del Hatch								X					
Ariel Parkinson								X					
Rich Snowden	X	X	X		X		X			X	X		

Growth Inducement III

CHAPTER III

GROWTH INDUCEMENT

Commentors requested additional analysis of the growth-inducing effect of the project and the impacts associated with growth. There are different kinds of development that are likely to occur from Dow's project and these vary from directly related industrial facilities and population growth to very subtle changes in the local and regional area. Several commentors want to know the impacts of further industrialization of Southeastern Solano County through projects unrelated to Dow facilities. The development related to Dow's facilities is distinguished from development unrelated, where possible.

RELATED, INDIRECT, AND INDUCED DEVELOPMENT

The study by Stanford Research Institute in the spring of 1975 indicated that among the "downstream"* industries it was likely a vinyl chloride polymerization plant would be constructed near the Dow facilities. Since SRI felt more sure of that type of facility, estimates of its employment were made specifically. Other downstream industrial employment was projected for Northern California as a unit since these plants might locate throughout the region. Some types of plants might find it more convenient to stay in the general area of the Dow plant so that Contra Costa County would receive a larger share of this development than other counties.

Indirect and induced impacts are discussed in the Draft EIR (pages V-38 and V-39) and consist of the following:

- Indirect Impacts - purchases by Dow and downstream facilities. These purchases of materials, parts, and supplies would occur throughout the Bay Area, but a large percentage would occur in the two counties.

---

*"Downstream" industry is one which uses a product of the Dow facilities and creates additional product value as well as basic employment.

- Induced Impact - Respending of income received by employees of Dow, downstream and "indirect" facilities. Commonly called the multiplier effect, this produces jobs in service industries and commercial establishments.

A rough estimate of new employment associated with these impacts is described in Table III-1. Also shown are estimates of where the new employment would be derived. Due to the significant unemployment in Solano and Contra Costa Counties, and the fact that a good share of these people are qualified to move into these jobs, about one-third of the employment demand is assumed to be met by existing inhabitants of the area. Immigrants to the area would then be needed to account for the remaining needs. These new jobs bringing in employees and their families are expected to result in several thousand additional people who will reside in the two counties. Out of the 4,000 or so new inhabitants of Contra Costa County, about three-fourths, or 3,000, may settle in Eastern Contra Costa County Antioch-Pittsburg area). In Solano County, out of possibly 1,800 new inhabitants, almost all would be expected to reside in Fairfield, Suisun City, Vacaville, or Rio Vista. If these increments accrue to these communities in respect to existing populations, the following growth will be stimulated in response to the Dow project:

City	Estimated related, indirect, and induced population growth from Dow project and downstream facilities. Growth would occur over the next decade.
Antioch	1,700
Pittsburg	1,300
Fairfield/Suisun City	1,100
Vacaville	600
Rio Vista	100
Total	4,800

It should be emphasized that a number of assumptions were used in this evaluation and that the impact on the communities could be significantly greater or smaller. Perhaps the greatest degree of uncertainty exists with respect to Rio Vista since its population is small but, due to its location, a large number of people could conceivably choose to live there.

TABLE III-1

POSSIBLE APPROXIMATE EMPLOYMENT AND
POPULATION GROWTH FROM DOW PROJECT

	Dow Facilities	Vinyl Chloride Polymerization Plant[1]	Other "Downstream" Facilities[2]
New Employment Demand:			
Direct:			
Contra Costa County	590	150	>100
Solano County	410	0	<100
Indirect:[3]			
Contra Costa County	170	150	>100
Solano County	80	0	<100
Induced:[4]			
Contra Costa County	600	200	>100
Solano County	350	0	>100
Total New Demand:[5]			
Contra Costa County	1,360	500	>300
Solano County	840	0	>100
Demand Met Through:			
Existing Unemployed:[6]			
Contra Costa County	450	150	Unknown
Solano County	280	0	Unknown
Immigration:			
Contra Costa County	910	350	Possibly >300
Solano County	560	0	Possibly >100
Resulting New Population:[7]			
Contra Costa County	2,300	900	Possibly >700
Solano County	1,400	0	Possibly >250

[1]Vinyl chloride polymerization plant is likely to be located nearby in Contra Costa County due to the production of vinyl chloride monomer.

[2]"Downstream" facilities utilize the products of Dow's plant for subsequent processing and manufacturing. Stanford Research Institute has estimated that these facilities could employ more than 1,000 employees spread across Northern California. A portion would likely locate in Contra Costa County for transportation economics.

[3]Indirect employment would be more dispersed over the counties and in other Bay Area counties. These are estimates only derived from SRI analysis.

[4]Multipliers used are 1.72 for Solano facilities and 1.85 for Contra Costa facilities.

[5]These totals are obviously of less accuracy than the direct employment numbers.

[6]Estimates are based on current unemployment in these counties. It is impossible to predict the situation five or ten years from now.

[7]New population is estimated at 2.5 people per employee.

Impacts of Development

The possible vinyl chloride polymerization plant would likely be located nearby to minimize handling and transporting the product. The plant itself would have cooling water and process water wastes, and the potential for air contamination from the monomer would have to be evaluated and monitored closely to prevent potential occupational health problems. Other development might include plastics fabrication or resin manufacturing facilities.

The specific effects of additional related industries locating in the vicinity of Dow are hypothetical and will continue to be so until specific plans for their location are developed. Such planning should consider allowable water diversions and waste discharges as well as other environmental effects. At this time it appears there is adequate water supplies in East Contra Costa County for related development. Wastewater discharges to the Bay-Delta area are evaluated closely by the Regional Water Quality Control Boards and the impact to the estuarine system is likely to be small.

Population growth estimated previously will require additional homes, schooling facilities, transportation, and all utilities services. The total population growth associated with the project for the local area is estimated at 4,800 over the next 10 years. This figure can be compared to a 37,000 population increase shown over the decade through ABAG Losouth projections for the six communities listed in Table III-2. Therefore, the Dow project would account for an estimated 13 percent of the growth projected to occur by the lowest of the three ABAG growth levels. Stated another way, the project-related population growth might account for about a 3-1/2 percent total increase in 1975 populations of these communities. These percentages might not be appropriate for each city, especially for Rio Vista.

For the estimated level of growth (480 people per year), additional homes and school facilities should not generally be a problem in the communities. If several of Dow's proposed production facilities happen to come on line at about the same time and large numbers of operating personnel are brought into the area in a short period, a temporary housing shortage could result. However, adequate liaison between Dow officials, City and County planning staffs, and developers would tend to minimize any housing problems which might occur. Likewise, a large influx of children into the school systems at any one time can

cause significant problems and, here again, liaison between Dow officials and school districts would help. These potential problems are discussed further in Chapter X.

TABLE III-2

COMMUNITY POPULATIONS

City	1970 Census	1975 State DOF Estimate	Projections		
			1980	1990	Source
Antioch	28,100	32,900	38,000*	50,000*	ABAG Losouth
Pittsburg	20,700	25,500	29,000*	38,000*	ABAG Losouth
Fairfield/Suisun City (excluding Travis AFB)	44,700	51,400	58,100	67,000	ABAG Losouth
Vacaville	21,800	27,800	29,900	38,800	ABAG Losouth
Rio Vista	3,100	3,200	3,100*	3,100*	ABAG Losouth
Rio Vista			4,900	9,000	Southeast Solano County & City Plan

* Adjusted downward from zonal estimates to account for unincorporated population

Utilities services in the communities are also generally adequate for this level of growth. Water and sewer facilities represent the largest utilities investments of local agencies and will be pressed the most if sudden growth occurs. In Chapter X, the water and sewer facilities are described in detail. Briefly, Fairfield will have adequate water and sewer facilities when the City's new plants are completed in 1976. Vacaville has several improvements to make to the systems and needs capacity increases. A major sewage project is also needed at Rio Vista and new water supply wells will be needed when future growth occurs. Antioch has adequate facilities for growth, but present sewage practices are inadequate and large capital improvements are needed regardless of Dow's project. Pittsburg is in the process of doubling its water treatment capacity, but sewage facilities are also

inadequate and major improvements must be made. The result is that the utilities major problems are the sewage facilities. These problems are in the process of being handled, but for several more years, Antioch and Pittsburg are likely to be continuing their primary plant discharges. Appropriate planning is extremely important in this area and the County, the Cities of Antioch and Pittsburg, and the East/Central County Wastewater Management Agency must maintain close contact with Dow staff to plan and construct adequate wastewater transportation, treatment, and disposal facilities.

SOLANO COUNTY DEVELOPMENT

The possible development in Southeastern Solano County, its magnitude and adverse and beneficial effects, is a complex and uncertain subject. The Draft EIR indicates that there will be some impetus to additional industrial development resulting from the Dow project, not because of improved facilities but due to a commitment by the County that would implement the General Plan for Southeastern Solano County. In addition, PG&E has been planning a power facility at Collinsville and ARCO recently announced plans for a petrochemical facility east of the proposed Dow facility in Solano County. It would be possible to project alternative growth patterns and evaluate them considering current and possible future environmental standards. This information would be of limited value in deciding on the Dow project since it is speculative and the general effects of industrialization can be anticipated as indicated in this section. The time required for such an exhaustive analysis far exceeds the appropriate level of effort for an EIR but is appropriately part of general planning studies for industrial development.

To provide a basic yardstick to assess certain of the impacts from this growth, the following assumptions regarding employment have been made:

POSSIBLE EMPLOYMENT
SOUTHEAST SOLANO INDUSTRY

Dow	410
Pacific Gas & Electric	240
ARCO	1,000
Southern Pacific Land Company Property	350
National Steel Property	1,000

These figures do not reflect a detailed assessment of the level of employment projected by PG&E or ARCO and are only rough estimates for the purposes of determining comparative impacts with regard to other manufacturing areas.

Air and Water Quality

Detailed general projections could be made regarding air and water emissions, shipment frequency, and other important factors. However, detailed assessment is not realistic and should not be part of this report since:

- It will require at least six months of detailed study and cooperation from other potential industrial developers.
- Project planning, even at the Dow site, is in the preliminary phases and accurate projections of shipping, transportation volumes, and air emissions are difficult to make.
- Overly pessimistic assumptions would imply greater impact than would occur and would not anticipate implementation of increasingly stringent air, water, and land use controls that will take place in the coming years.

This report provides an information base for initial planning decisions such as zoning and the Williamson Act cancellation as part of permit applications to Federal, State, and other local agencies. Data and information will be provided as detailed designs are completed.

There is one common problem associated with projecting adverse impacts resulting from the industrial development described. Each new facility will be subject to land use, air, water, and solid waste regulations that are in effect at the time the facility is proposed. Also, each facility must be operated under requirements of varying stringency depending on changes in regional, State, or national policy. This is not to say that potentially adverse impacts should not be assessed. An industry does not have the right to emit waste or alter land use but rather operates under privileges granted by society. The nature of the privilege is defined from time to time based on public interest. In planning any new facility it is essential that the most stringent future discharge or emission criteria be projected to assure that compliance can be achieved and that adverse impacts of changes in order to achieve compliance are minimized.

Navigation

Improving the Sacramento and/or San Joaquin ship channels is not vital to the success of the project. However, deepening the channels would increase the efficiency of transport and, therefore, permit lower operating costs. The proposed Baldwin Channel (San Joaquin) project would provide deep water (35-foot draft vessel access as opposed to the present 30-foot) as far inland as Stockton and could possibly result in deepening of the Sacramento Deep Water Channel. It is in the process of being reviewed by the U. S. Army Corps of Engineers. The project would have significant economic benefits, but environmentalists and regulatory agencies have questioned its impact on water quality and the hydrologic characteristics of the Sacramento-San Joaquin Delta. Dow's project is not being planned to accommodate deep draft vessels.

Prudent industrial project planners would assure that their facilities can be served economically under present conditions. Nevertheless, the construction of plants that would benefit economically by the availability of larger vessels would obviously provide further economic justification for construction of deep water access. Whether this additional justification is sufficient to overcome current objections is a matter that will be evaluated by the State and Federal agencies and Legislatures.

Transportation

The road systems serving the Collinsville area will inevitably be improved as a result of the Dow project and further improved as a result of additional industrial expansion. At present, the Collinsville Road (see Transportation reponse) is not physically adequate to serve major development in the area. Existing Sacramento Northern Railway facilities do not extend east of Collinsville Road and would need to be under the Dow proposal. Added traffic on Highway 12 and Highway 160 could create peak hour traffic congestion and further justification for improvement of those facilities. However, significant improvements in the quality of highway access as well as the extent of rail service will not have a significant growth-inducing effect as far as major industries are concerned. If major industries are constructed, the feasibility of locating subsidiary industries could be increased as a result of highway and rail improvements created for the larger facilities.

The operation of ferry service from the vicinity of Pittsburg to the Montezuma site would greatly improve the access to the area without corresponding adverse effects resulting from highway travel. However, such regular ferry service might make it easier to locate additional facilities in the area; therefore, at least initially, it should be planned for service to the Dow facility only.

Solano County Planning

The existence of a general manufacturing use designation in the General Plan--1990 for Southeastern Solano County is in itself a growth inducement as is the discussion on pages 93-95 of that Plan regarding port facilities (see Chapter XI, Williamson Act, Figure XI-1). If no such projection had been made, the location of the site would create pressures for development. However, of equal importance is the willingness of Solano County to accept industrial development in certain areas. The recommended mitigation measure with regard to additional local and regional planning could also be interpreted as growth inducing. Such planning would show an intention of Solano County and ABAG to plan jointly for appropriate industrial locations and develop the necessary support facilities that would be required.

The Dow facility, unlike other basic community service extensions, will not make other industrial growth easier in Southern Solano County. As emphasized in the Draft EIR, it will add to a developing industrial growth climate and if approved will constitute a policy, although not legal precedent, with regard to further industrial development in the area. However, it has long been generally assumed that PG&E would at some time construct a power facility at Collinsville. The purchase of that property and the zoning of the Southern Pacific Land Company and National Steel properties have added considerably to the appropriateness of the area for industrial development.

Population

The population implications for Solano County of the industrial employment referred to previously will depend on the timing of the new developments, the extent to which this employment can be met by the existing labor force, and the amount of commuting from outside the County. None of these factors can be predicted with accuracy, but for the purpose of assessing impacts several assumptions, including a "worst case" assumption, will be made.

With respect to timing, it is clear that the new direct employment will be spread over a considerable period of time. In the case of the Dow facilities, for example, the increase in employment would be spread over the five- to seven-year period required to construct the facilities. A similar period could be expected for the ARCO plant, following ground-breaking, the timing of which is highly uncertain at this point. Except for the brewery, the timing of other developments is highly uncertain. It seems clear, therefore, that new direct employment would be unlikely to reach the level indicated for at least 15 to 20 years and that such growth would, in practice, be gradual.

As was indicated in the Draft EIR, unemployment has remained relatively high in the Vallejo-Fairfield-Napa Metropolitan Area since 1970--ranging between 5.1 percent and 6.0 percent of the labor force. Furthermore, there is considerable commuting by Solano County residents to jobs outside the County (8 to 12 percent) and by residents of the Fairfield-Suisun City area to jobs outside the area (more than 20 percent)(Stanford Research Institute, 1975). Some of the new jobs, therefore, would be taken by persons who are already residents and would not generate population increases. There could also be an increase in secondary employment (employment by family members other than heads of households) which would tend to reduce the population effect.

Population growth may also be reduced by reason of commuting to Solano County plants by residents of other counties. It is not possible to predict the extent to which this might occur, but some commuting from Contra Costa, Napa, and Sacramento Counties can be expected. However, it is likely that most of the population growth will take place in Fairfield, Vacaville, and Rio Vista.

Given the above, the worst case (in terms of population growth) would reflect complete development within 10 years and all new jobs filled by immigrants to the County each constituting a three-person family. Under these assumptions, new direct employment would increase at a rate of 334 per year and population at a rate of 1,000 per year, or 10,000 over the decade. In addition, employment in people-serving activities would increase by about 2,400 over the decade, or at a rate of about 240 per year.* The population increase associated with this growth depends on the

*Based on a self-sufficiency index of 42 percent for the Fairfield-Vacaville area and the resulting multiplier of 1.72. See earlier report for details.

extent to which these jobs are filled by family members of residents, but under worst-case assumptions would approximate 700 per year or 7,000 for the decade.

Total population growth is then 17,000 over the next decade. This represents a 20 percent increase in current population of Fairfield, Suisun City, Vacaville, and Rio Vista and would place a large burden on all types of public facilities.

Solano Economic Factors

The local service requirements of Dow employment could result in the need for additional community services, particularly in Rio Vista, but perhaps also in Fairfield, Vacaville, and Suisun City.

If other industries are also established, their effect could be significant. It could be argued that with additional services available, Rio Vista would attract residents who commute to northern Contra Costa County. This is an indirect growth-inducing effect that would result from the project and/or subsequent projects.

The adequacy of certain existing local services is discussed in the chapters on Transportation and Economics. Preliminary assessment of local capability is that the Dow project would not require any additional major support facilities. However, when the level of industrial development in Southeastern Solano County results in total residential growth exceeding 10 to 20 percent in Rio Vista and Fairfield, it will be necessary for these communities to make major capital investments in such facilities as water, sewer, and fire protection. The communities of Rio Vista and Fairfield have shown a willingness to support growth, and, in fact, testimony at the Solano EIR hearing showed that some residents of Rio Vista felt that the community lacked recreational and medical facilities that would be made available if growth occurred.

A potential fiscal problem arises because the new plants will be located in the unincorporated area, whereas the new employees and their families will, for the most part, reside in Fairfield, Suisun City, Vacaville, and Rio Vista. The considerable assessed value and property tax revenue from these plants will not be directly available to these cities to offset the costs of the services that will be provided to the new residents. Another problem arises because the new plants will not be located

in the school districts in which most of the children of the new employees will be residing. These problems are discussed below.

School Districts. The inequities characterizing local financing of school districts has long been recognized. The California approach has been ruled unconstitutional and steps are underway to remedy the problem. By the time the developments under consideration have been completed a new financing mechanism will have been instituted. Discussions with the State Department of Public Instruction indicate that some form of Statewide equalization--either by formula applied to local assessments or by a State property tax earmarked for education--will be implemented within a few years. This will eliminate current inequities and ensure, for Solano as well as for other counties, a balancing of revenues and expenditures. Facilities such as Dow's and ARCO's and to a lesser but significant extent the other proposed plants, will contribute in school taxes many times the educational costs associated with the children of their employees.

Other Local Government Units. The earlier report indicated the very high assessed value per employee associated with the new Dow facilities and their significant contribution to assessed valuations in the County. The ARCO plant will provide comparable assessed value per employee because of the large capital investment per employee. The assessed values per employee for the other plants could vary over a wide range depending on their characteristics. The net effect would be highly positive for the County and the special districts in which the plants would be located, and downward pressure on County and special district tax rates could be expected.

As indicated above, these plants make no direct contribution to city revenues. However, most of the induced commercial development will occur in the existing cities (unless regional centers are located outside the city limits), as will the residential development associated with the new residents. This will result in increased property and sales tax revenues.

The combination of sales and property taxes on commercial activities and property taxes on residences has been found in many studies of the fiscal impact of new developments to be sufficient to offset the additional costs (other than education) associated with the increased population.* In practice, the net balance will depend on a number of factors:

- The excess capacity, if any, that currently exists with respect to community service facilities (including public buildings, water, streets, sewage treatment).
- The geographical distribution and density of new residential and commercial development (e.g., high density developments should have low per capita street needs).
- The requirements placed on developers to provide streets, sidewalks, roads, and other facilities or to contribute to the capital cost of certain public facilities.
- The income and educational levels of the new residents (relates to the demand for social services, and the need for recreation and library facilities).

It is not possible, given the available information, to project the fiscal balance of the cities with any degree of precision. However, an examination of the various categories of revenue suggests there will be an adequate revenue base.

Revenues Associated with Real Property Wealth--The property tax in fiscal year 1973-74 provided about 20 percent of total revenues in Fairfield, 26 percent in Vacaville, and 12 percent in Rio Vista. Growth rates would vary according to the rate and character of growth in commerical activities and the quality and density of residential development. As the cities grow in size, the rate of commerical development may exceed the historical rate and contribute a relatively larger proportion of total revenue. Reliance in the property tax in these cities has been less than the State average (24 percent in 1973-74), and this relationship should continue.

*See Thomas Muller, Fiscal Impacts of Land Development, The Urban Institute, 1975, for detailed discussion.

Revenues Associated with Income and Consumption--Sales and use taxes account for 19 percent of total revenues in Fairfield and Vacaville and 24 percent in Rio Vista, higher than the State average of 15.5 percent. The increased commercial development expected to accompany population growth should stimulate these revenues significantly.

Population-Unit Revenues--Much of the revenue from other agencies is related to population and should grow roughly in proportion to population. These revenues account for about 32 percent of total revenues in Fairfield and Vacaville and 27 percent in Rio Vista.

Miscellaneous Revenues--These revenues include fees, user charges, fines, licenses, and other items.* For the most part, these revenues tend to increase proportionately with population growth.

CONCLUSIONS

The economic effects of the new developments that may occur in Southeastern Solano County are likely to be positive rather than negative. Even in the case of cities which do not receive a direct property tax contribution from the new developments, an adverse fiscal impact is unlikely. Population growth attributable to these developments is expected to be less than that currently being used in the County for planning purposes and capital investments for water and waste disposal facilities are already being made or are planned. Although there is a tendency for per capita expenditures for municipal services to increase as population increases, the increments expected to result from the new developments are relatively small, and the increased property and sales tax revenues from associated commerical development should be sufficient to provide the necessary revenue/expenditure balance without tax rate increases (directly attributable to the new residents).

*Rio Vista has relatively large natural gas royalty income (20 percent of the total) which affects the relative importance of other sources.

MITIGATION

- The industrial growth-inducing effects of this project in Solano County could be significantly mitigated by adoption of County policies regarding industrial development and the establishment of criteria for acceptable industrial and residential uses.

- To minimize any adverse impacts associated with the proposed development and to assure appropriate planning for accommodating any future industrial development in the area, Solano County should reaffirm its policy opposing urban development in unincorporated areas, specifically in the southeastern part of the County. This could be added as an amendment to the General Plan for Southeastern Solano County or as a separate policy statement limiting urban growth only to incorporated communities.

- To mitigate any potentially adverse regional impacts and to assure that both local and regional planning precedes completion of the proposed project and planning studies for other industries, a subregional development study should be initiated in Solano County in cooperation with Contra Costa County and ABAG to provide detailed projections for land use, transportation, utilities, and public investments and employment. The result could be amendments to the General Plan--1990 Southeastern Solano County to reflect current policies and conditions.

- Wastewater planning in East Contra Costa County will be critical in the next year or two as the potential regional system is designed. Dow officials should establish frequent communication with City, County, and Wastewater Agency planners to insure that adequate capacity will be provided for population growth.

Air Quality IV

CHAPTER IV

AIR QUALITY

Several comments were received on the Draft EIR regarding the lack of air quality effects. Therefore, a dispersal analysis was conducted of projected air quality with and without the proposed Dow chemical plants for the year 1980. Comparison was also made with the prediction year 1973 because of the availability of rather complete base data for that particular year. Three sets of meteorological conditions were applied for 1980 predictions for photochemical substances (oxides of nitrogen, reactive hydrocarbon, and ozone), and one set of meteorological conditions for unreactive species (sulfur oxides, unreactive hydrocarbon, oxides of nitrogen as a system). The model used in calculating photochemical oxidant has been calibrated and applied successfully in other Northern California locations. All analyses were conducted under application of Bay Area Air Pollution Control District June 1975 Guidelines.

METHODOLOGY AND ASSUMPTIONS

Emissions

The Bay Area Air Pollution Control District (BAAPCD) has compiled a list of mobile and stationary pollutant emissions for the entire Bay Area, which data formed the basis of the emission inventory applied in this study. Emissions data were augmented by estimated emissions for the proposed plants derived for and presented in the Draft EIR as follows:

Pollutant	Estimated Plant Emissions Tons Emitted Per Day	
	Pittsburg	Montezuma
Hydrocarbons	1.0	1.5
Oxides of Nitrogen	1.5	10
Oxides of Sulfur	<0.05	8

Meteorology

A set of meteorological conditions which occurred during a day of maximum oxidant concentrations in Concord and Pittsburg in 1973 was chosen for initial calibration of the models. The parameters of the set consisted of wind speed, stability class, inversion height and wind direction. These same conditions were then employed in the 1980 predictions of air quality; in addition, two more wind direction trajectories were analyzed for 1980.

Baseline Meteorological Case. On June 21, 1973, the maximum hourly average oxidant concentration in Concord was .23 ppm and in Pittsburg, .14 ppm. Oxidant levels on that day, in fact, exceeded the air quality standards at every BAAPCD station except San Francisco. According to the BAAPCD meteorological records for that day the vertical mixing was restricted, and the wind was generally from the south to southeast in the early morning in the Concord and Pittsburg area, shifting to a marine wind from the west (through the Golden Gate) by 1600 hours. There was 27 percent cloud cover at San Francisco, and a mean wind speed average from San Francisco and Oakland International Airports of approximately 4 meters per second. This data was entered into the computer analysis as a wind speed of 4 meters per second, a stability Class D, an inversion height of 150 meters, and a wind trajectory, shown as trajectory A on Figure IV-1 (BAAPCD, June 15, 1970).

Additional Meteorological Cases. The meteorological parameters described above were employed in the 1980 emissions dispersal analysis. In addition, two other wind patterns were chosen; these are shown on Figures IV-2 and IV-3 as trajectories B and C.

Mathematical Models

For unreactive pollutants, the Turner model is used to predict ground level pollutant concentrations resulting from emissions from one or more stacks. Stack parameters including height, flow rate, diameter, and temperature are used in the calculations to generate an effective stack height, which has a strong bearing

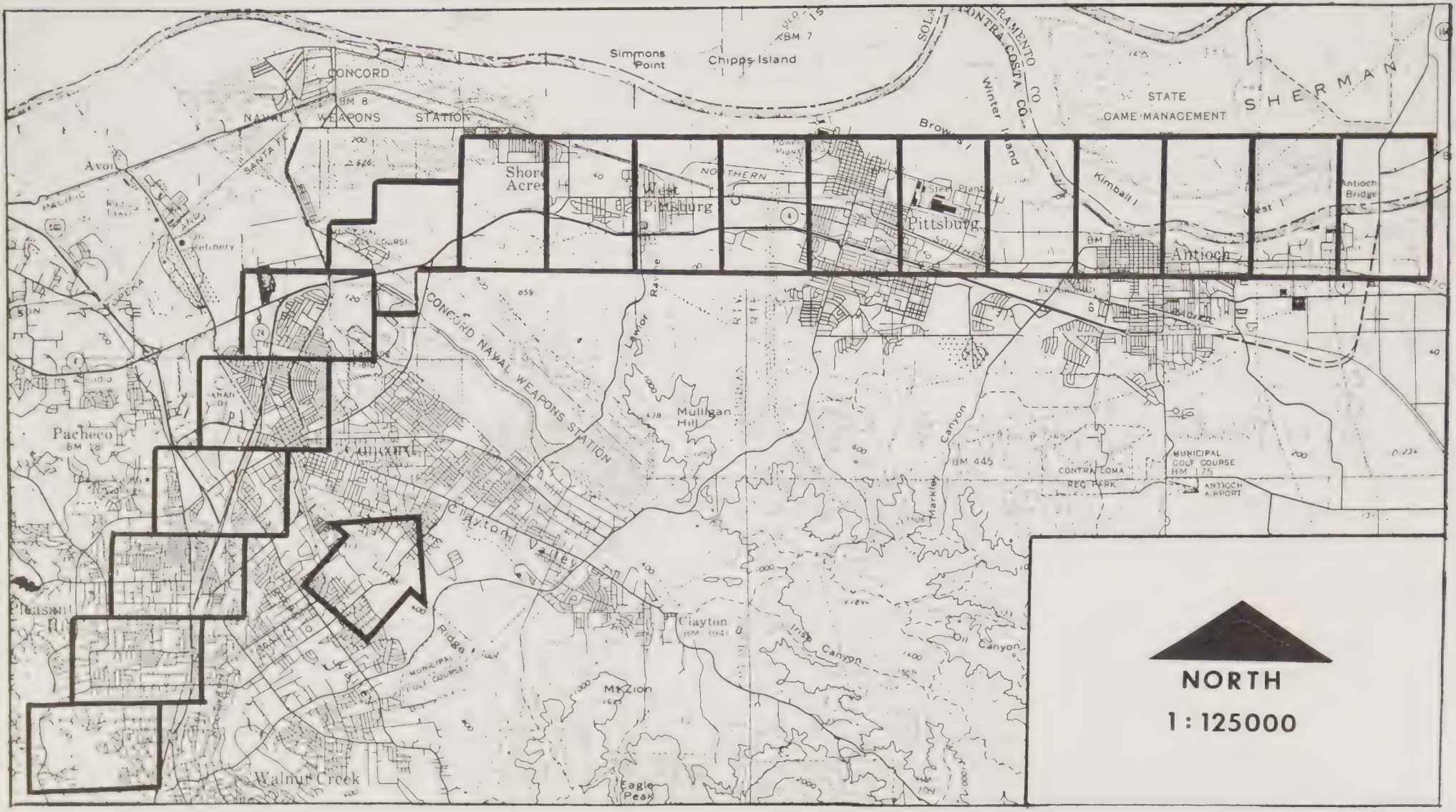


FIGURE IV- 1
TRAJECTORY A

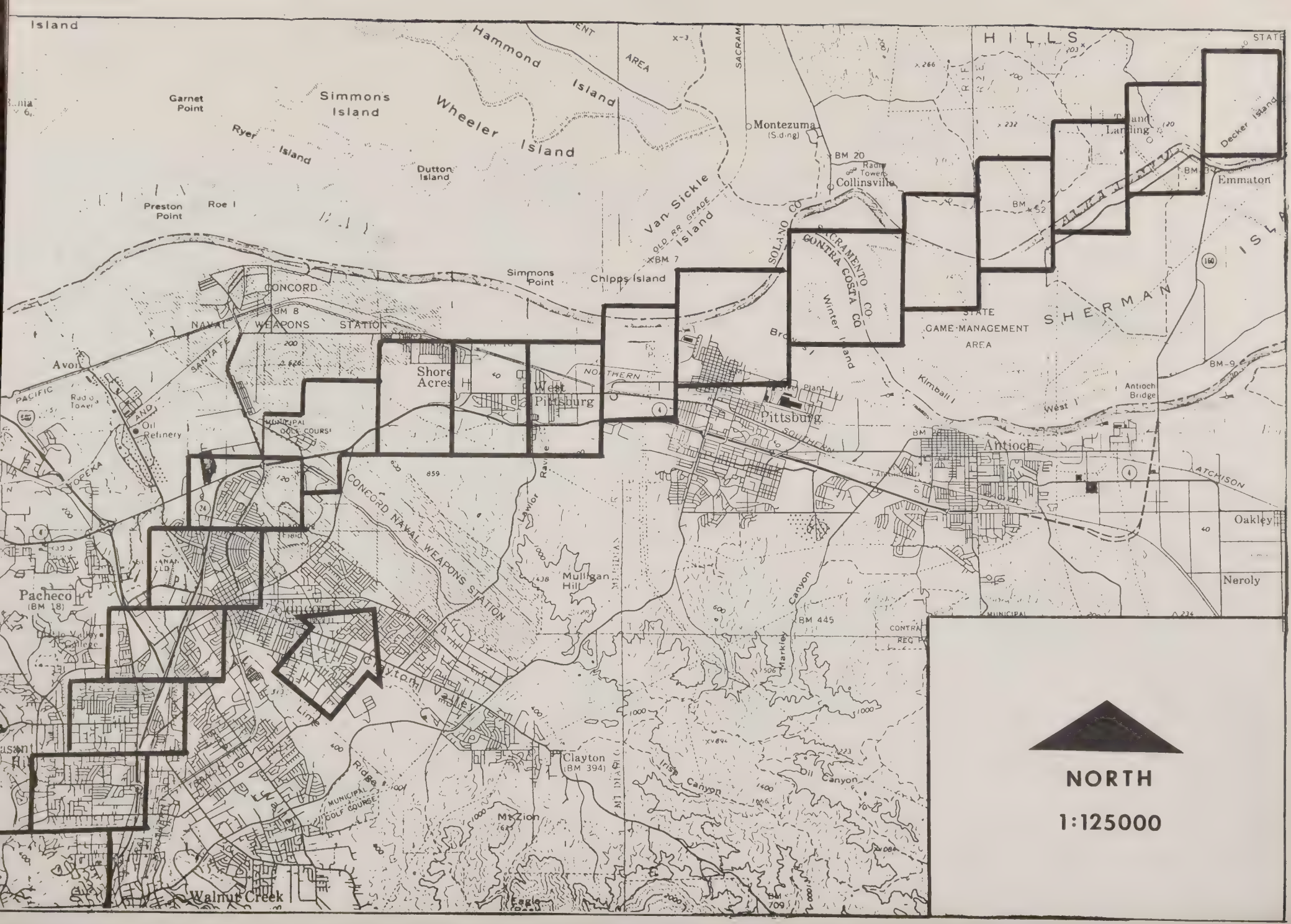


FIGURE IV-2
TRAJECTORY B

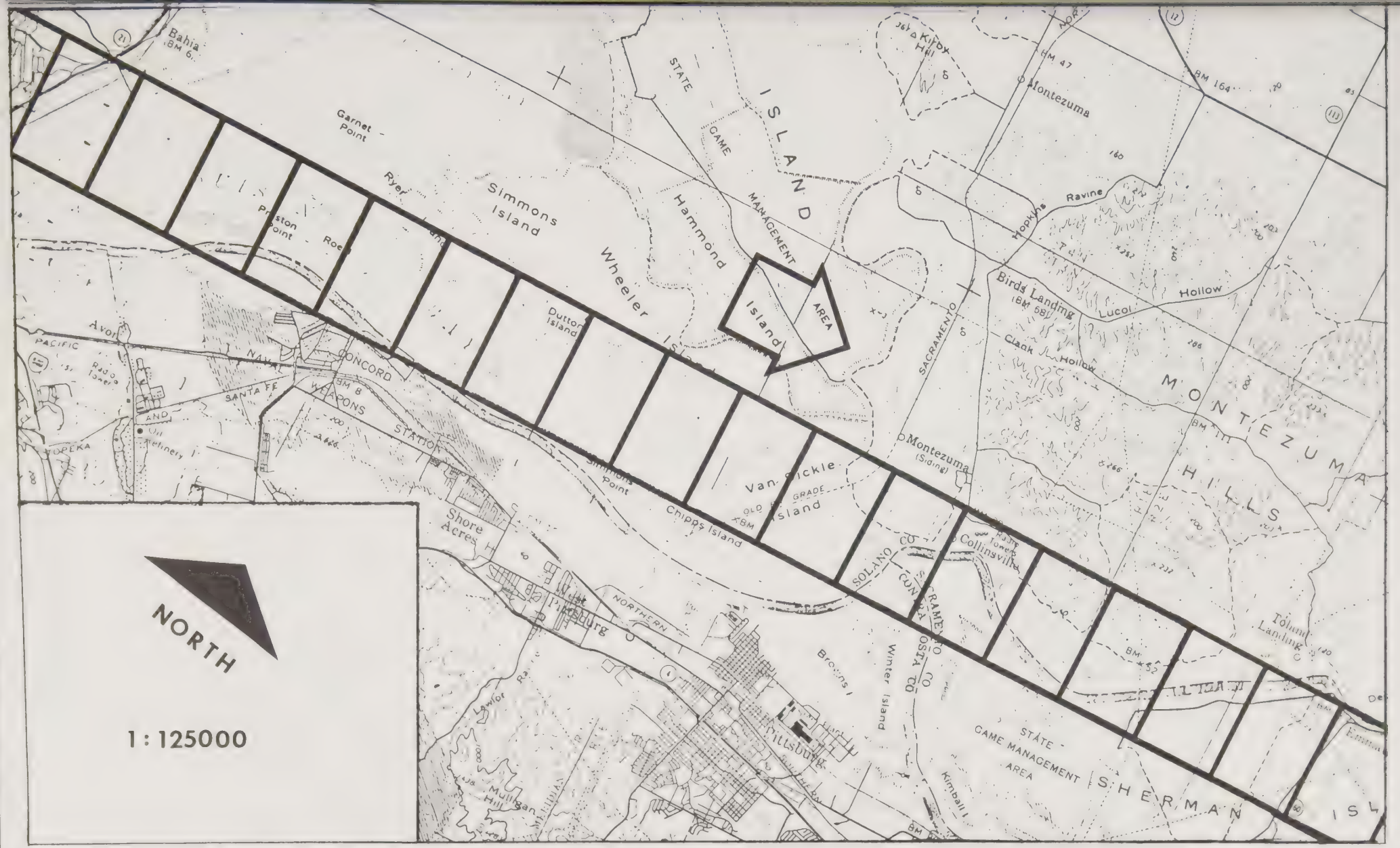


FIGURE IV-3
TRAJECTORY C

on the results of the analysis. Because the proposed plant complex is still in the planning stages, such detailed information on stack operations was not available, and the following assumptions were used in modeling local pollutant concentrations resulting from plant emissions:

- The proposed plants at Montezuma and Pittsburg can each be considered area sources.
- Area source emissions can be approximated by choosing a virtual point source upwind of the area (see Turner, pp. 39-40). A square kilometer grid, centered about each plant, as chosen as the area source with the virtual point source located on the midpoint of the upwind side.
- Meteorological conditions as previously presented are applicable.

Use of the square kilometer area source provides an easy means of comparison with the Earth Metrics mesoscale model; correlation between the two is satisfactory, although the Turner model produces slightly lower pollutant values.

The Earth Metrics mesoscale photochemical model was applied for the different wind trajectories. Each trajectory (parcel width) is three kilometers wide, composed of three one-kilometer-wide trajectories actually running in parallel. Grid cells were grouped into larger rectangles, six kilometers square in area, and averaged. These average values were used to calibrate the model, and comprise the output.

The method of analysis used divides all of the land area addressed into a square grid. It then considers all of the air space above each grid square to compromise an air volume of fixed height characterized by the inversion height for an effective ceiling above which no atmospheric mixing takes place on a given day. The model allows for air flow to take place among the various volumes of air among individual grid squares. In addition, photochemical reactions of air pollutants in the presence of sunlight are allowed to occur. The movement of air pollutants is trapped over discrete time steps. At the beginning of each time step, the effective change due to photochemical reactions for the entire time interval is calculated and the transport of pollutants from one volume to another due to wind is calculated. All pollutants emitted at ground level are assumed to be instantaneously vertically and completely mixed up to the height of the inversion lid.

Results of Analysis

As stated previously, the model for prediction of photochemical oxidant was initially calibrated to a specific smog episode in June of 1973; a comparison of computed results with measured oxidant values is presented on Figure IV-4. Projected 1980 oxidant levels were computed for each of the three trajectories without input of Dow emissions. These serve as controls, by which the results, including Dow emissions, can be compared. Figures IV-5 and IV-6 show predicted 1980 oxidant levels for trajectory A, without and including emissions from the Pittsburg plant, respectively. Figures IV-7 and IV-8 show projected oxidant levels for trajectory B, accounting for Montezuma plant emissions. Dispersal of nonreactive oxides of sulfur were modeled for trajectory C, and Figure IV-9 shows the control SO_x levels, while Figure IV-10 shows levels resulting from the inclusion of Montezuma plant emissions. Each block represents average pollutant concentration over the six to nine square kilometers encompassed by the block; thus, computed concentrations within a block may be somewhat larger or smaller than the averaged value.

Local dispersal of pollutants was calculated to produce ground level pollutant contours for each proposed plant. A steady, one-directional, 4 m/s wind was assumed although both contour maps show pollutant levels resulting from a westerly wind, the axis of the wind trajectory can be rotated in any direction about the center of plant emissions to indicate effects from a different wind direction. Contours resulting from Montezuma plant oxides of sulfur emissions are presented on Figure IV-11, and contours resulting from Pittsburg plant oxides of nitrogen emissions are shown on Figure IV-12. Zero background levels have been assumed.

Pollutant values of contours on Figures IV-11 and IV-12 can be converted to indicate values for other pollutants emitted by the plants. Conversion factors are given in Table IV-1. As an example, to convert the 0.15 parts per million (ppm) SO_x contour from the Montezuma plant to a contour for NO_x, Table IV-1 gives a conversion factor of 1.74. Thus, the NO_x value of this contour is 0.26 ppm. Computed centerline pollutant concentrations (i.e., concentrations along the wind axis through the center of emissions) for pollutants not shown on the contour maps can also be read from Tables IV-2 and IV-3. Table IV-4 shows applicable ambient air quality standards.

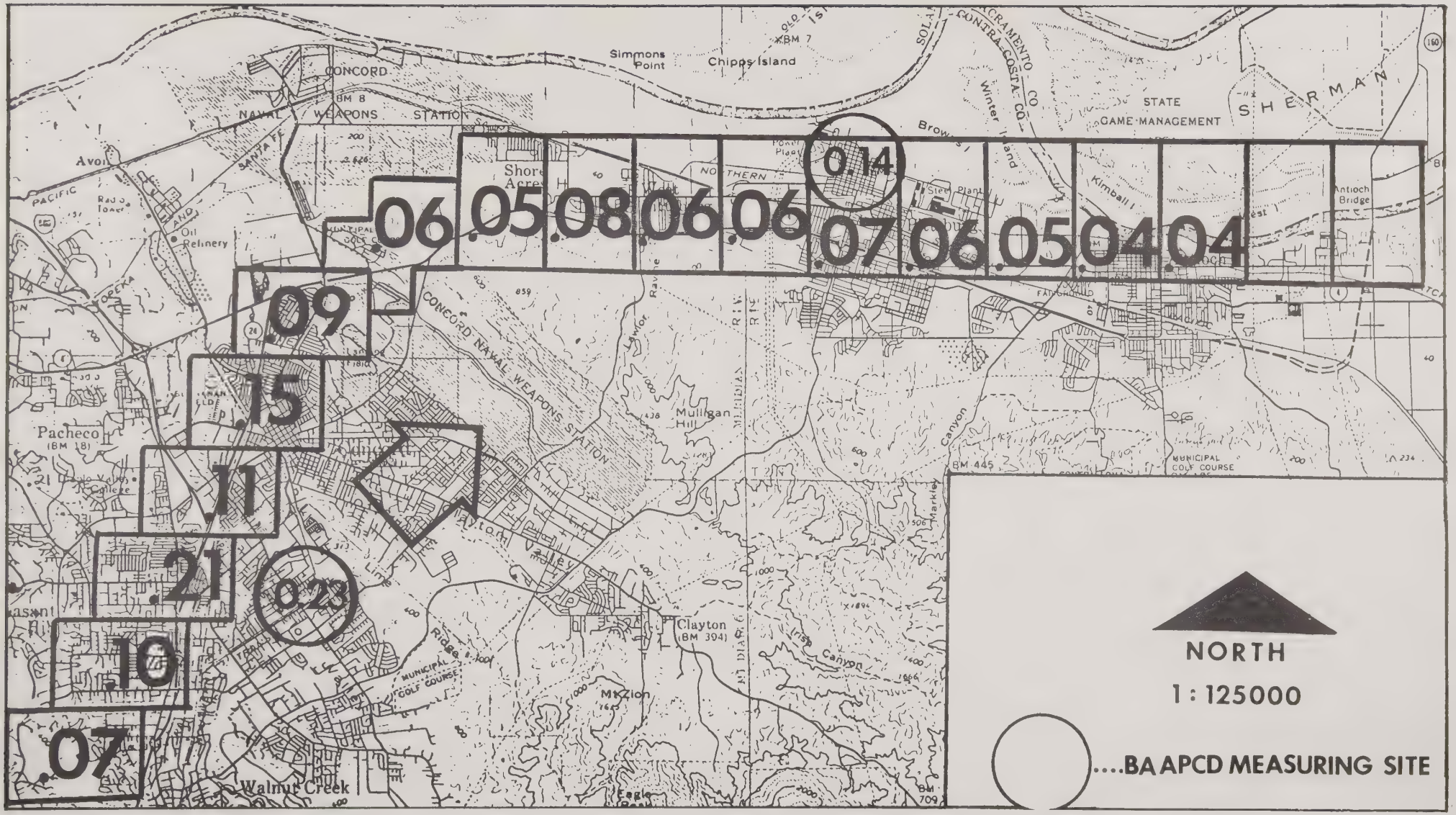


FIGURE IV-4

AVERAGE OXIDANT CONCENTRATIONS FROM COMPUTER SIMULATION OF JUNE 21, 1973 EPISODE (PPM), INCLUDING BAAPCD MEASURED OXIDANT VALUES AT CONCORD AND PITTSBURG

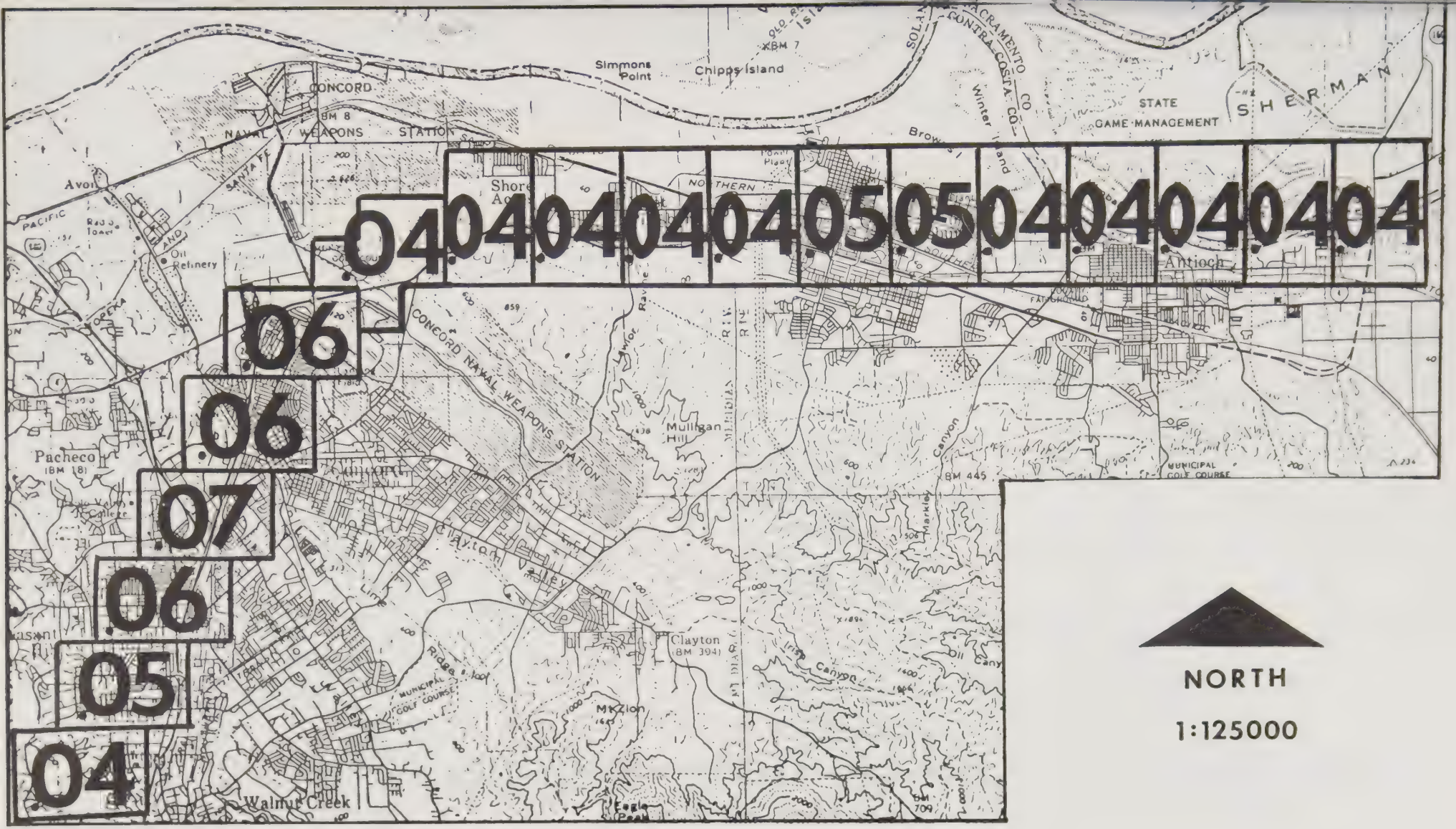


FIGURE IV-5

COMPUTER SIMULATION OF 1980 OXIDANT CONCENTRATIONS (PPM), TRAJECTORY A. PROPOSED DOW COMPLEX NOT INCLUDED

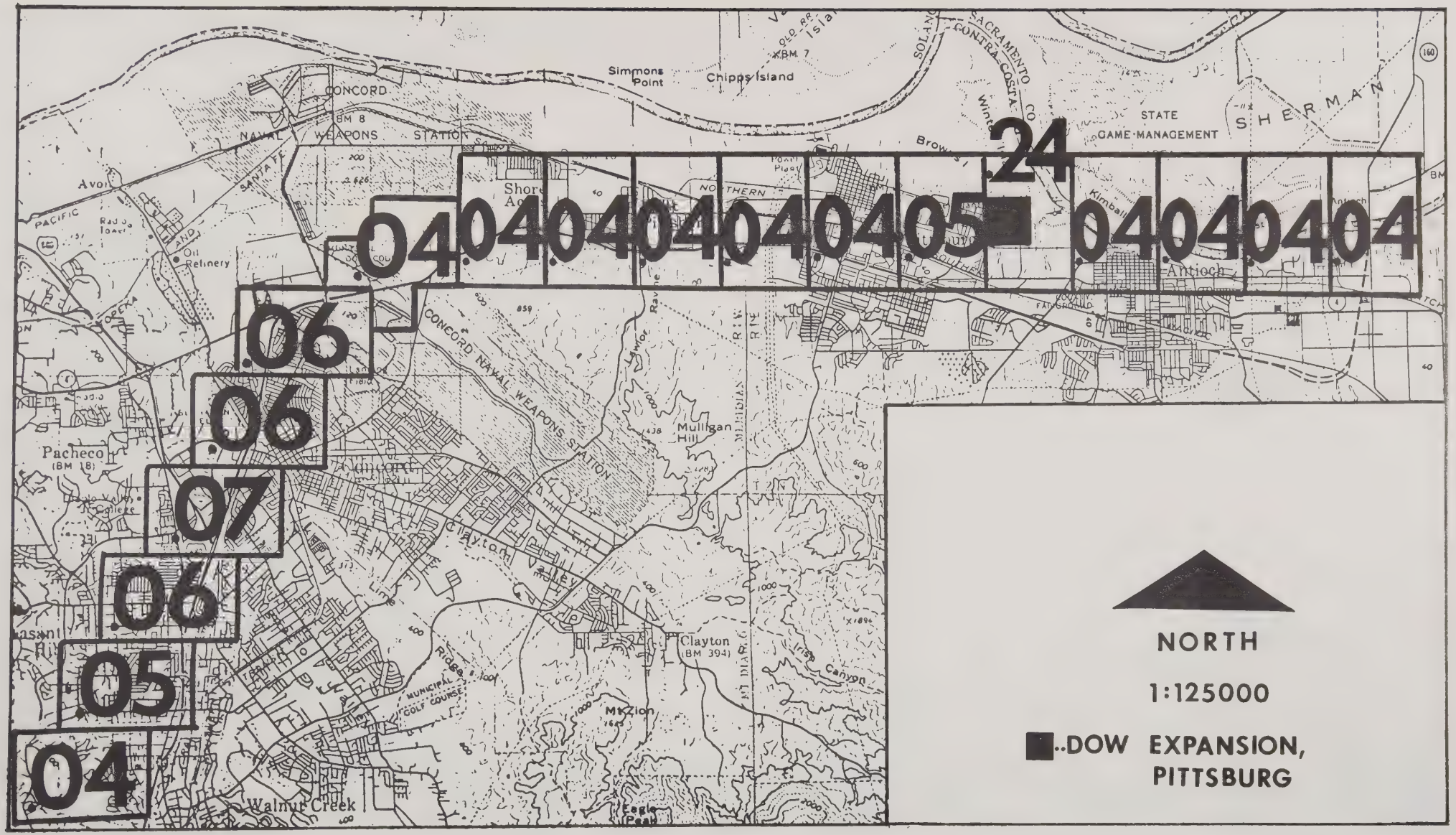


FIGURE IV-6
COMPUTER SIMULATION OF 1980 OXIDANT CONCENTRATIONS (PPM), TRAJECTORY A.
DOW EMISSIONS FROM PROPOSED PITTSBURG EXPANSION INCLUDED

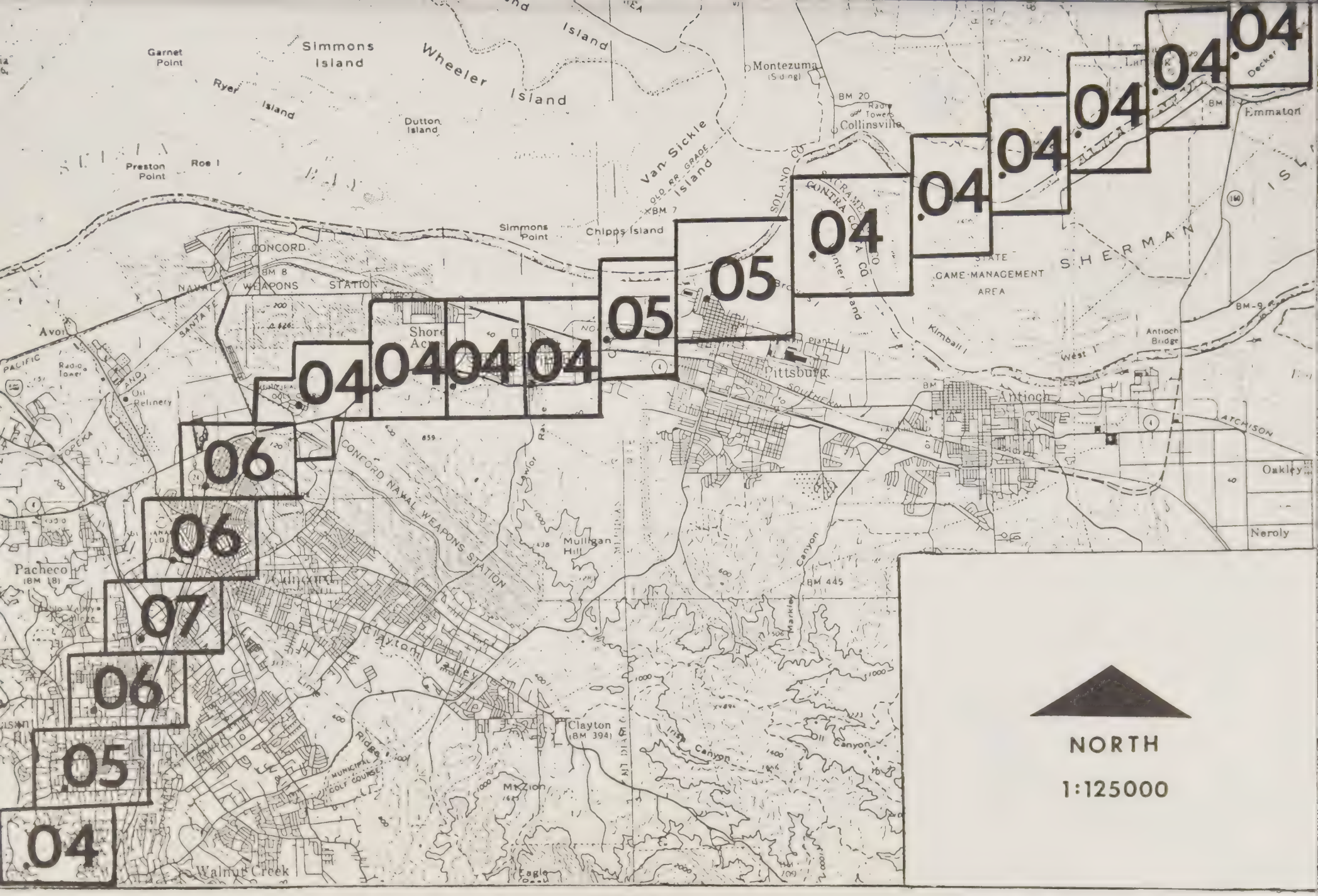


FIGURE IV-7

COMPUTER SIMULATION OF 1980 OXIDANT CONCENTRATIONS (PPM), TRAJECTORY B. PROPOSED DOW COMPLEX NOT INCLUDED

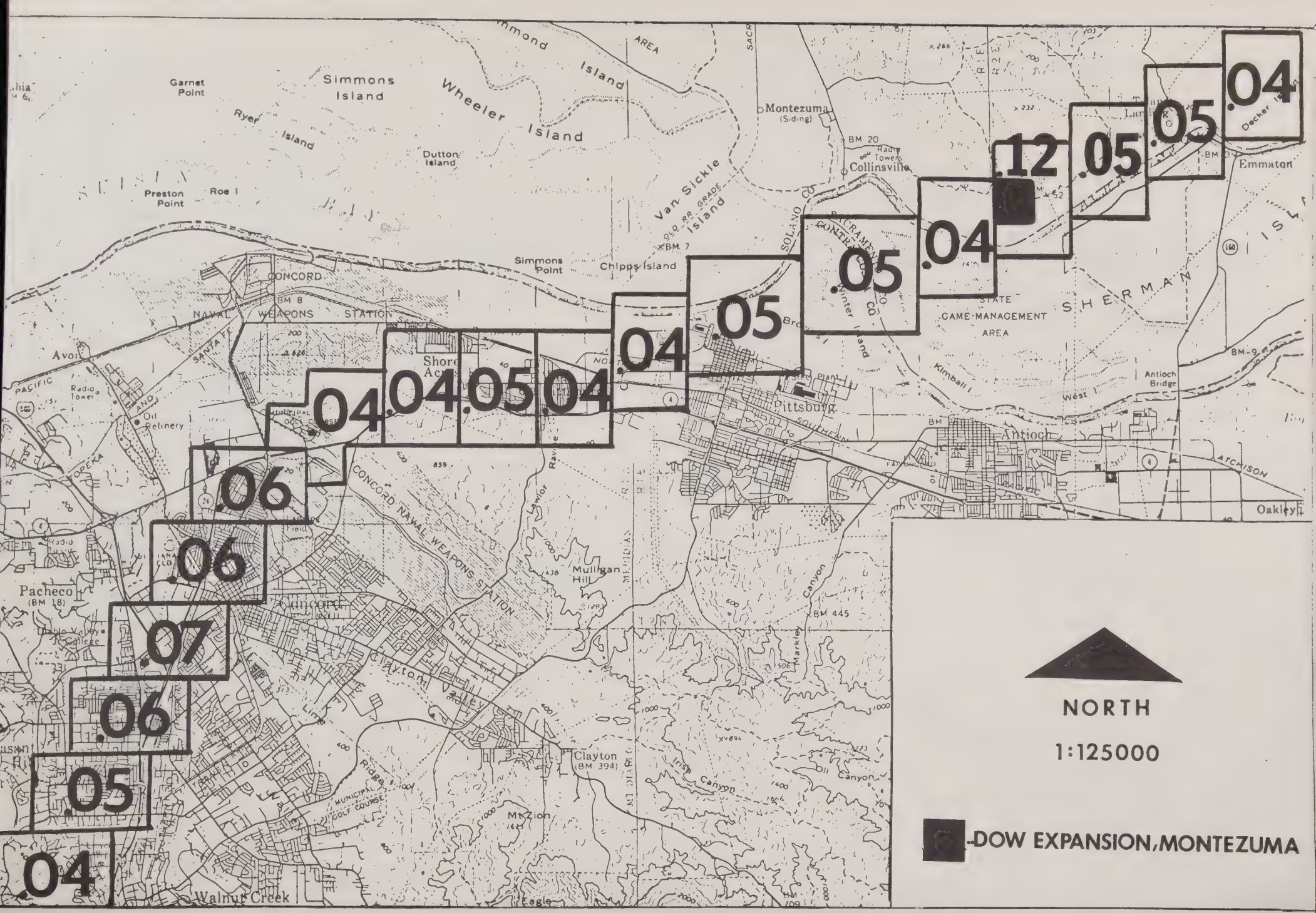


FIGURE IV-8
COMPUTER SIMULATION OF 1980 OXIDANT CONCENTRATIONS (PPM), TRAJECTORY B.
EMISSIONS FROM PROPOSED MONTEZUMA PLANT INCLUDED

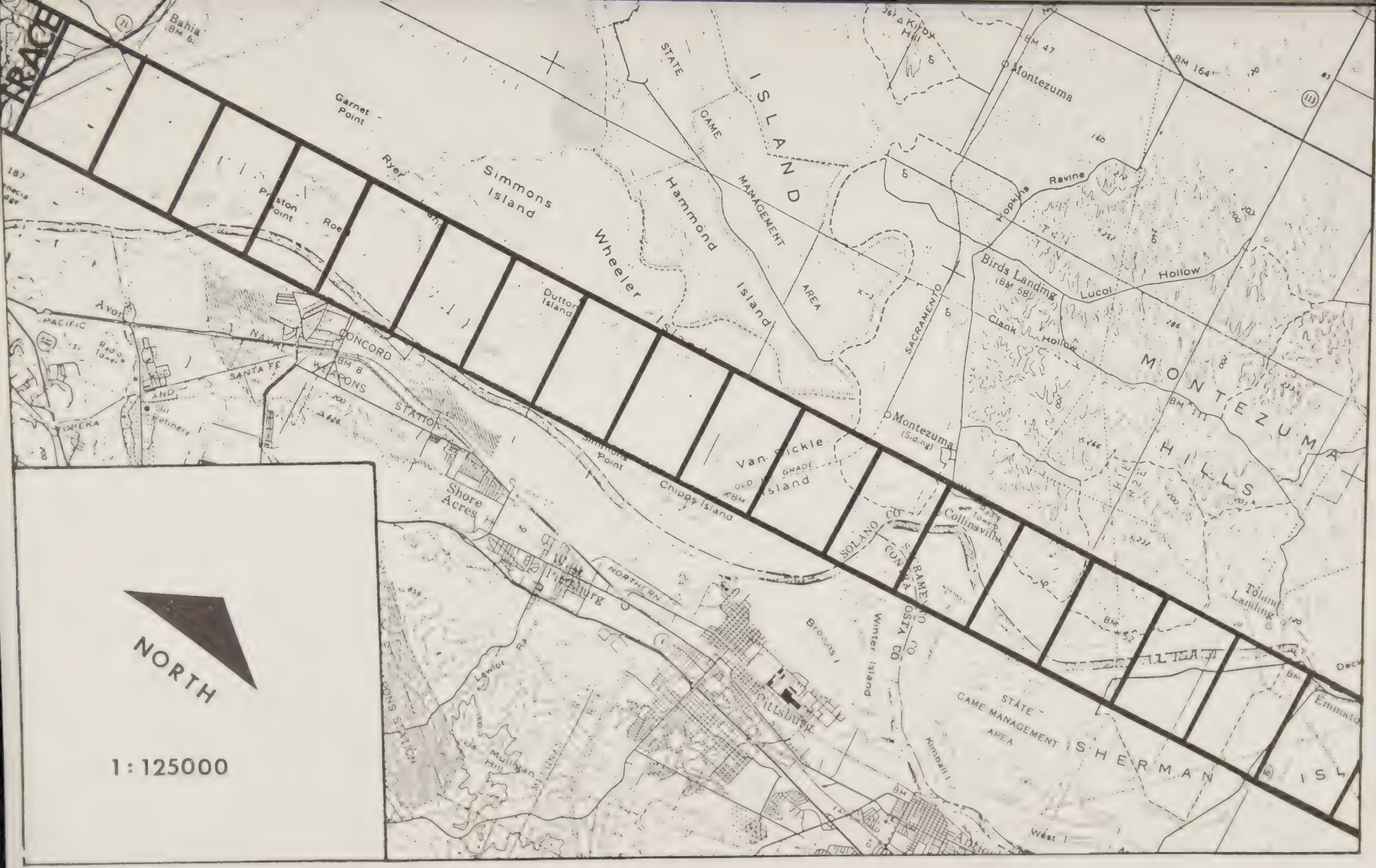


FIGURE IV-9

COMPUTER SIMULATION OF 1980 SO_x CONCENTRATIONS (PPM), TRAJECTORY C. PROPOSED DOW COMPLEX NOT INCLUDED.

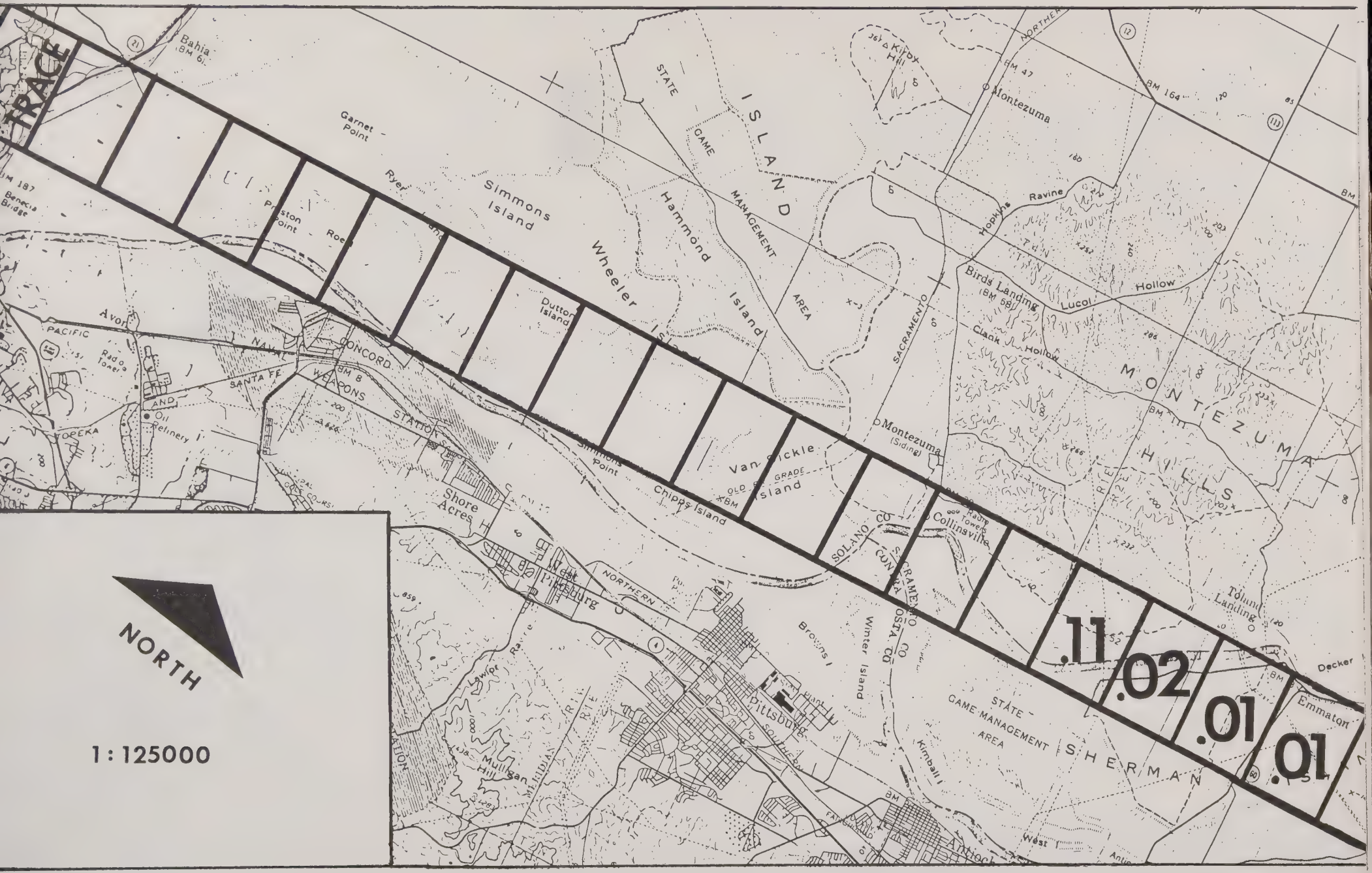


FIGURE IV-10
COMPUTER SIMULATION OF 1980 ONE HOUR SO_x CONCENTRATIONS (PPM), TRAJECTORY C.
EMISSION FROM PROPOSED DOW COMPLEX AT MONTEZUMA INCLUDED

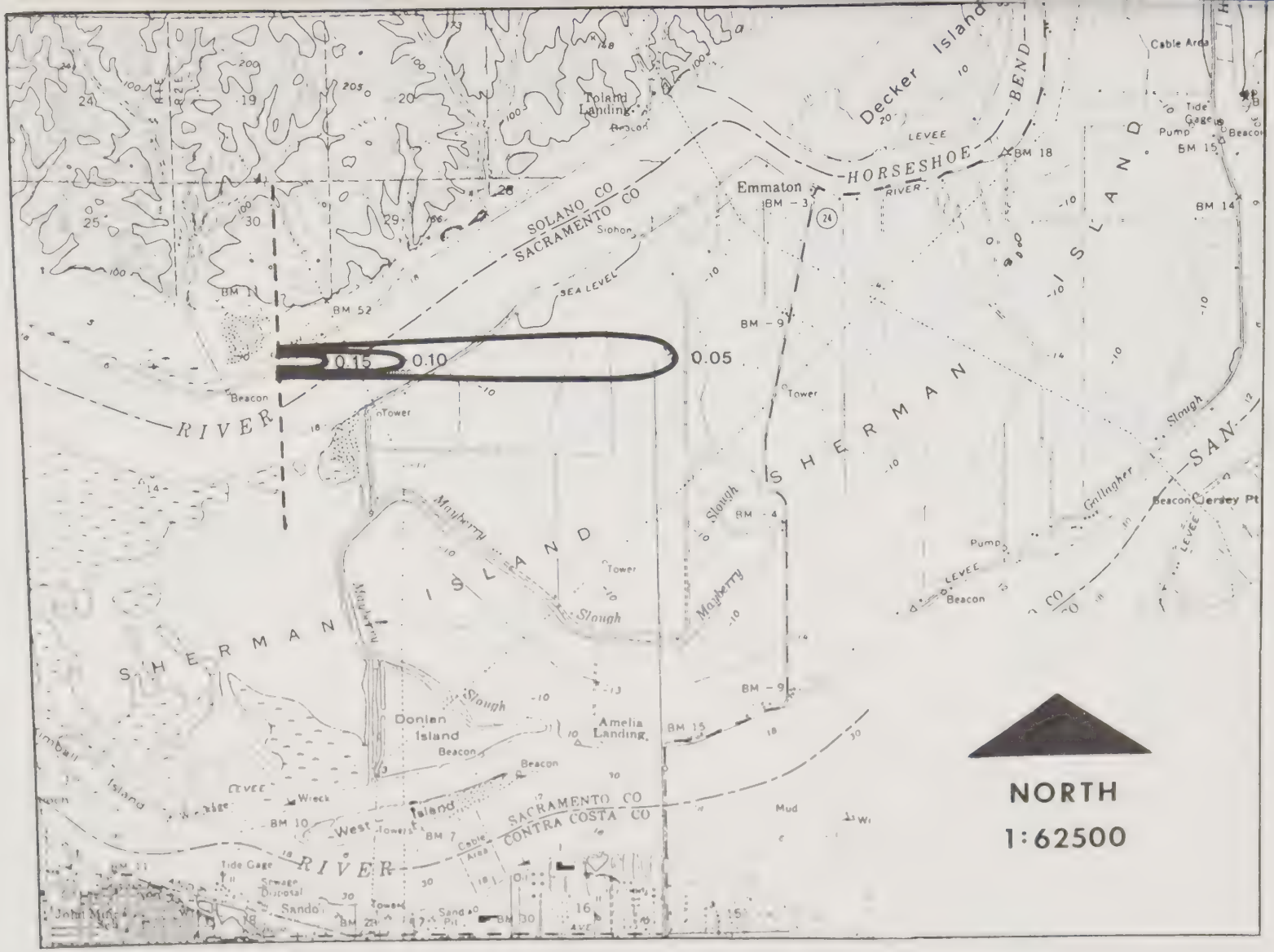


FIGURE IV - II
CALCULATED ONE HOUR SO_x CONCENTRATIONS (PPM), PROPOSED MONTEZUMA PLANT

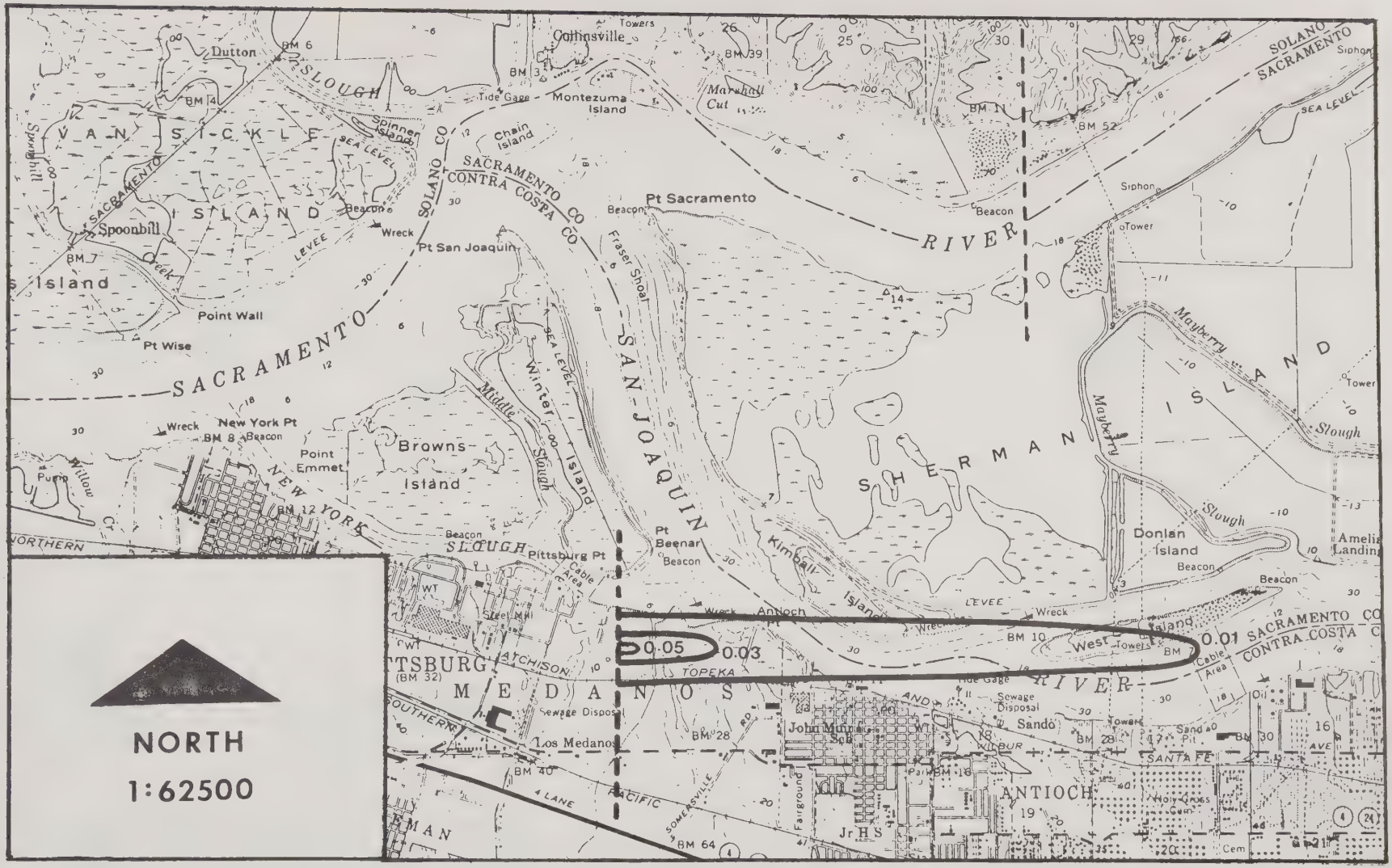


FIGURE IV-12

CALCULATED ONE HOUR NO_x CONCENTRATIONS (PPM), PROPOSED PITTSBURG PLANT

TABLE IV-1

CONVERSION FACTORS FOR
FIGURES IV-11 AND IV-12

Multiply Contour Value in BY To Obtain Contour Value for	Figure IV-11 (Montezuma Site)	Figure IV-12 (Pittsburg Site)
Oxides of Nitrogen (ppm as NO_2)	1.74	--
Oxides of Sulfur (ppm as SO_2)	--	0.024
Total Hydrocarbon (ppm as CH_4)	0.75	1.92

It must be stressed that the meteorological condition of a 4 m/s wind does not constitute a worst case for nonreactive pollutant dispersal. This value was chosen as a worst case for modeling reactive photochemical oxidant, and employed in the nonreactive model to ascertain consistency of results. Because pollutant concentration resulting from a source emission varies approximately as the inverse of wind speed, a wind speed of 1 m/s, for example, could produce concentrations four times as high as indicated by the contours and tables. Further meteorological study should determine a wind speed frequency distribution for the Montezuma-Pittsburg area, from which a worst-case wind speed can be chosen.

TABLE IV-2

CALCULATED CENTERLINE ONE-HOUR POLLUTANT CONCENTRATIONS
RESULTING FROM OPERATION OF THE PROPOSED MONTEZUMA PLANT (ppm)
(distance measured from leeward plant boundary)

Distance from Boundary (km)	Oxides of Nitrogen (as NO_2)	Oxides of Sulfur (SO_2)	Total Hydrocarbon (as CH_4)
0.2	0.31	0.18	0.14
0.5	0.26	0.15	0.11
1.0	0.20	0.11	0.09
1.5	0.16	0.09	0.07
2.0	0.14	0.08	0.06
3.0	0.11	0.06	0.05
4.0	0.09	0.05	0.04
5.0	0.07	0.04	0.03

TABLE IV-3

CALCULATED CENTERLINE ONE-HOUR POLLUTANT CONCENTRATIONS
RESULTING FROM OPERATION OF PROPOSED PITTSBURG COMPLEX (ppm)
(distances measured from leeward plant boundary)
Trace < 0.001

Distance from Boundary (km)	Oxides of Nitrogen (as NO_2)	Oxides of Sulfur (SO_2)	Total Hydrocarbon (as CH_4)
0.2	0.05	0.001	0.09
0.5	0.04	0.001	0.07
1.0	0.03	trace	0.06
1.5	0.03	trace	0.05
2.0	0.02	trace	0.04
3.0	0.02	trace	0.03
4.0	0.01	trace	0.02
5.0	0.01	trace	0.02

TABLE IV-4

NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	Primary[1]	Secondary[2]	Method[3]
Photochemical Oxidants (Corrected for NO_2)	1 hour	160 µg/m³[4] (0.08 ppm)	160 µg/m³[4] (0.08 ppm)	Chemiluminescent Method
Carbon Monoxide	8 hours	10 mg/m³ (9 ppm)	10 mg/m³ (9 ppm)	Nondispersive Infrared Spectroscopy
	1 hour	40 mg/m³ (35 ppm)	40 mg/m³ (35 ppm)	
Nitrogen Dioxide	Annual Average	100 µg/m³ (0.05 ppm)	100 µg/m³ (0.05 ppm)	Colorimetric Method Using NaOH
Sulfur Dioxide	Annual Average	80 µg/m³ (0.03 ppm)	60 µg/m³ (0.02 ppm)	
	24 hours	365 µg/m³ (0.14 ppm)	260 µg/m³ (0.10 ppm)	Pararosaniline Method
	3 hours	--	1300 µg/m³ (0.5 ppm)	
Suspended Particulate Matter	Annual Geometric Mean	75 µg/m³	60 µg/m³	High Volume Sampling
	24 hours	260 µg/m³	150 µg/m³	
Hydrocarbons (Corrected for methane)	3 hours (6-9 am)	160 µg/m³ (0.24 ppm)	160 µg/m³ (0.24 ppm)	Flame ionization detection using gas chromatography

[1]Primary Standard: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.
[2]Secondary Standard: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
[3]An equivalent method of measurement may be used but must have a consistent relationship to the reference method to be approved by EPA.
[4]Corrected for SO_2 in addition to NO_2.

Summary of Projected Pollutant Levels

- Oxides of sulfur emissions may be responsible for concentrations on the order of 0.15 ppm extending from Montezuma sources. These projected values are for low wind speeds (moderately unfavorable meteorology). These will occur within plant boundaries or over unpopulated river areas. Even under lower wind speeds, the concentrations greater than .15 ppm will occur over either Dow property or river areas. Ambient one-hour air quality standards for sulfur dioxide will not be exceeded by normal contributions from Pittsburg plant emissions; they may be exceeded by contributions from Montezuma plant emissions under the following circumstances.

    1. Unfavorable meteorological conditions (most likely a low-velocity north wind under inversion conditions), and

    2. A high percentage of Montezuma SO_x emission is emitted as SO_2, and

    3. Presence of an abnormally high background of sulfur dioxide, approaching the standard for a one-hour averaging time.

- Emissions of oxides of nitrogen from the Montezuma plant may produce concentrations above ambient NO_2 air quality standards; however, these would occur either inside plant boundaries, over the river, or over unpopulated areas adjacent to the site. Standards would probably be exceeded by Montezuma plant contribution only under the following circumstances:

    1. There exist unfavorable meteorological conditions as described above, and

    2. A significant percentage of Montezuma NO_x is emitted as NO_2, and

    3. A background concentration of NO_2 in the order of .05 ppm is present (this is regularly measured at the Pittsburg BAAPCD station).

- Hydrocarbon emissions from both plants could possibly cause air quality standards for hydrocarbons to be exceeded, under very unfavorable meteorological conditions. Comparison with the EPA National Air Quality Standard for hydrocarbons can be made by multiplying the derived one-hour predictions by a factor of 0.83 to approximate pollutant levels for a three-hour sampling time (see Turner). Reactive hydrocarbon background levels are not well known for the Bay Area; however, it appears from existing data that this standard is regularly exceeded today throughout the region. However, this will not be the case in 1980.

- Oxidant levels resulting from emissions from either the Pittsburg or Montezuma site may exceed both State and National standards for ambient air quality on the project site. Because oxidant concentration is dependent upon emission rates of reactive hydrocarbons and the NO_2 content of oxides of nitrogen emissions, a more detailed characterization of the reactivity of plant emissions would be desirable to more fully gauge potential effects of plant emissions on areawide smog levels, when design level data and details of reactivity of hydrocarbons are developed by Dow in the design process.

EFFECTS OF POLLUTANTS

Increased emissions will slightly increase ambient concentrations of a variety of pollutants, especially in the local areas surrounding the two sites. Even though air quality standards may not be violated off site, the Dow plants will increase the pollutant concentrations over the respective values if the plants were not constructed.

Carbon Monoxide

Carbon monoxide is a colorless, odorless, tasteless gas. It is formed as a by-product of the incomplete burning of carbon-carrying fuels. The standards provide health protection against the occurrence of carboxy-hemoglobin (COHb) in the blood of two percent or more. Dow plans to emit a very small amount of carbon monoxide in comparison with the sources in the general area, and, since the levels are not expected to approach the standards, the impact will be slight or even negligible.

Nitrogen Dioxide

Nitrogen dioxide is a brown-colored gas seen as a brown haze during days of poor air quality. It is one of several oxides of nitrogen known to exist and which originate in high temperature combustion processes. In its direct health effects, NO_2 is associated with a variety of respiratory diseases among populations of all ages. It also affects vegetation, causing growth retardation, and impairing water intake, expecially in fast growing plants (Mukammal, 1968). In addition, NO_2 is an essential component in the natural production of photochemical oxidants. The previous evaluation has shown that the standards could be exceeded at the sites under certain conditions. The results may be more significant in the production of oxidant than in any direct environmental effect.

Hydrocarbons (HC)

The term hydrocarbons refers to many different substances which are made up of complex molecules containing carbon, hydrogen, and oxygen in varying proportions. Hydrocarbons in the air come mainly from the processing, marketing, combustion, and other use of petroleum products.

The EPA standard for HC is a maximum three-hour average of 160 $\mu g/m^3$ which is to be exceeded no more than once per year and applies only to the period of the day between 0600 and 0900 hours. In addition, it applies only to the reactive hydrocarbons, which excludes the component methane, a simple organic gas present naturally in the atmosphere in concentrations on the order of 1,000 $\mu g/m^3$.

The standard has been set in this way solely to limit the amount of reactive HC available to take part in the formation of photochemical oxidant. While the role of HC in this formation is not yet completely defined, the necessity for sunlight and the reaction times needed generally means that the maximum early morning HC concentrations are precursors of the maximum oxidant concentrations at about 1200-1400 hours on days of poor air quality.

The standard is not set to directly protect against health hazards, apparently because of a lack of conclusive experimental data. It is known, however, that biologically active HC carcinogens are present in the atmosphere in far higher concentrations in urban and industrial areas than in rural regions. Effects on vegetation occur due to at least one type of hydrocarbon, namely,

ethylene, at levels on the order of those now found in urban ambient air. Ethylene is a normal plant hormone; in greater concentrations than are induced by nature, ethylene may produce adverse effects (Mukammal, 1968).

As discussed previously, the Dow project could possibly cause air quality standards for hydrocarbons to be exceeded. In that respect, there are potential significant adverse effects and more detailed study is suggested to quantify the impact and implement mitigation measures, if possible.

Particulates

Particulate matter, either solid or liquid, consists of particles of varying size (2-30μ), and composition. It may originate in nature or as a result of almost any human activities; dust, mist, ash, smoke, fumes, and pollen are all particulate matter. The primary standards are designed to protect the public health; the secondary standards protect against effects on soil, water, vegetation, materials, animals, weather, visibility, and personal comfort and well-being. The human health effects of particulate matter consists primarily of direct injury to the lung and introduction of various toxic substances deep into the lung. Plant injury occurs when particulate matter plugs leaf stomates thus reducing the exchange of gases necessary for growth and development.

Even though particulate standards are violated at Pittsburg on several days each year, Dow emits an insignificant quantity. Future emissions are also expected to be very low or negligible. However, to the present problem in the area, Dow should make every attempt to keep all sources in check, including dust blowing off the baseball diamond.

Sulfur Dioxide (SO_2)

Heating and burning fossil fuels such as coal and oil releases their sulfur content into the air. Of the chemicals which are present in industrial gaseous effluents to make up the sulfur oxides (SO_x), the most abundant is SO_2, which often further oxidizes to form sulfur trioxide (SO_3) and which combines with moisture in the air to form sulfuric acid mist (H_2SO_4). The health effects of SO_2 and particulates are related, and most studies have measured both variables. These effects range from

increased mortality at extremely high concentrations to respiratory infections in children and bronchitus prevalence where standards are exceeded regularly. These levels have never been approached even on peak days in Pittsburg. However, the analysis showed that during certain meteorological conditions, the standards could be exceeded at the Montezuma site. In that regard, there could be some inpact to employees. The interaction of the water vapor, cooling tower drift, and sulfur emissions could produce some acid mist. The levels are unknown at this stage, but the effects could be important to soils and vegetation immediately downwind. A study of this has been suggested in the Water Resources chapter.

Photochemical Oxidant

Photochemical oxidants (smog) are produced in the atmosphere when reactive organic substances (chiefly hydrocarbons) and nitrogen oxides are exposed to sunlight. The chief photochemical oxidants in California are ozone (O_3) and NO_2. The health effects of oxidants are primarily respiratory; irritation of mucous membranes in the respiratory tract and reduced resistance to respiratory infection. Nasal and eye irritation in subjects of all ages have been observed at levels at or near the standards. Oxidants also damage plants, most commonly by growth retardation and leaf injury, and many materials detriorate more rapidly in the presence of ozone than they do in natural circumstances.

The analysis for the Dow project has revealed that oxidant standards may be violated on site and that further study of hydrocarbon reactivity is needed to better define project impact.

Synergistic Effects

In investigations into the health effects of various atmospheric pollutants, there have been indications that the pollutants act synergistically to heighten the severity and incidence of adverse reactions. For instance, the effects of oxidants on the respiratory tract are intensified by the presence of particulates and by smoking. Likewise, the concentrations of both ambient hydrocarbons and particulates as well as cigarette smoking appear to play a role in the incidence of lung and skin cancers. Sulfur dioxide health effects appear to act additively with ozone levels, and are inextricably associated with ambient particulate concentrations. There is little quantitative information available on this subject as yet, but it may prove to be an important determinant of future air quality standards.

OTHER RESPONSES TO SPECIFIC AIR QUALITY COMMENTS

Predictions of Future Concentrations

The air quality analysis used techniques recommended by the Bay Area Air Pollution Control District. Alternate spatial scales were used and the results were discussed in terms of Federal and State standards.

Transport Toward Central Valley

No portion of the atmosphere is advantageous for disposal of gaseous pollutants. The effects of air pollutant transport toward the Central Valley have been specifically calculated in the foregoing analysis to gain an understanding of the nature of the impacts of plant operation on Valley residents (see graphical display for results).

Need for Photochemical Model Application

The validated Earth Metrics photochemical model was utilized to predict ambient air quality concentrations of oxides of nitrogen, hydrocarbons, and oxidants.

Relative Emissions Density

Emissions density from the proposed Montezuma plant are approximately one-fourth the density of an urban portion of the I680 (or other major freeway) corridor in terms of reactive hydrocarbons. In terms of oxides of nitrogen, the emissions density of the Montezuma Plant is approximately one-half such a comparison area; these results arise from assuming an even distribution of the plant's emissions over 600 acres.

Need for Solano County to Develop A Plan for Major Industrial Locations

Regional or subregional planning of industrial expansion is desirable from an air quality standpoint in order to assess critical receptor areas and develop comprehensive plans which permit industrial expansion while maintaining or improving air quality levels.

Technology

Calculations of SO_x dispersal is presented along with a discussion of health effects. Mitigation should consist of analysis of alternate techniques of on-site recovery and use, and in any case, stack gas scrubbing should be considered using latest available technology. Compliance with Section 3121 will be shown at the time of permit application--the preferable course of action expressed by the Bay Area Air Pollution Control District.

High temperature catalytic reduction of the off gases or latest equivalent technology should be considered in detail design.

MITIGATION MEASURES

Several mitigation measures were identified in the Draft EIR. Those measures and those developed as a result of this air quality analysis are shown on Page XVIII-2.

REFERENCES

Bay Area Air Pollution Control District Guidelines, San Francisco, California, June 1, 1975.

A Study of Air Flow Patterns in the San Francisco Bay Area, San Francisco, California, BAAPCD Information Bulletin, June 15, 1970.

Mobile and Stationary Emissions, unpublished data of the BAAPCD.

Contaminant and Weather Summary, BAAPCD monthly publication, San Francisco, California, July 1973.

Hanna, Steven. Application of a Simple Model of Photochemical Smog, National Oceanic and Atmospheric Administration, Oak Ridge, Tennessee, October 1973.

Hogan, C. Michael, Patmore, L. C., Crimp, David. Air Quality for the Proposed Expansion of Dow Chemical Company at Montezuma and Pittsburg, October 1975.

Hogan, C. Michael, Patmore, L. C., DeGioia, K. A. Air Quality Impact of the West Contra Costa County Sewerage Treatment and Disposal Expansion, U. S. Environmental Protection Agency EIS, Earth Metrics, Incorporated, Palo Alto, California, May 1, 1975.

Mukammal, et al. Air Pollutants, Meteorology, and Plant Injury, World Meteorological Organization, 1968.

Patmore, L. C. & Hogan, C. Michael. Air Quality Element to the General Plan, City of Livermore, Earth Metrics, Incorporated, Palo Alto, California, January 10, 1975.

Turner, D. Bruce. Workbook for Air Pollution Dispersal Estimation, U. S. Environmental Protection Agency.

Water
Resources V

CHAPTER V

WATER RESOURCES

Comments have included concerns about the proposed diversion and discharge system at the Montezuma site, receiving water impacts, runoff, erosion, dredging, water system operation, and pipeline construction. These comments have been grouped into common topics for responses.

WATER SYSTEM DESCRIPTION

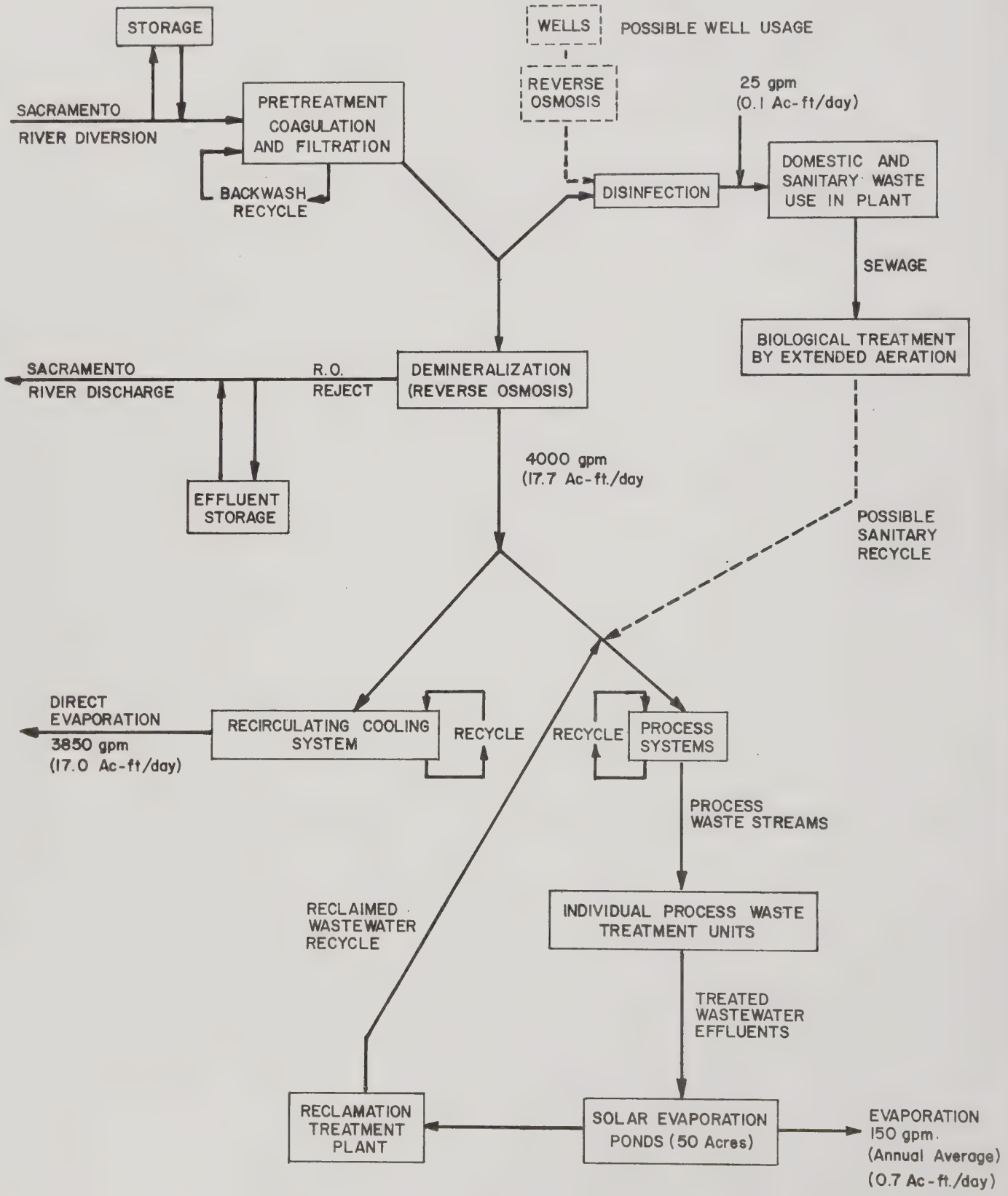
Figure V-1 shows a flow diagram of the proposed water system at Montezuma. The only discharge to the Sacramento River is reverse osmosis reject water, with about three-fourths of all water diverted eventually being evaporated, either directly in the cooling towers or through the solar evaporation ponds. The Draft EIR related that about 2,000 gpm would be evaporated in the cooling towers. Subsequent analysis by The Dow Chemical Company shows that 3,850 gpm will be evaporated directly although it is possible that final designs will reduce this amount. Figure V-2, coupled with the attached "Notes on System Operation", gives more detail about the diversion-discharge system.

The Pittsburg plant is in the process of eliminating its once through river cooling waters by constructing recirculating water cooling towers. No river diversion system will be utilized at Pittsburg in the future, but reverse osmosis reject discharge will continue. Contra Costa Canal water will be used as source water for Pittsburg plant needs, although a portion of plant needs will continue to be met through wells.

Wastewater Discharge

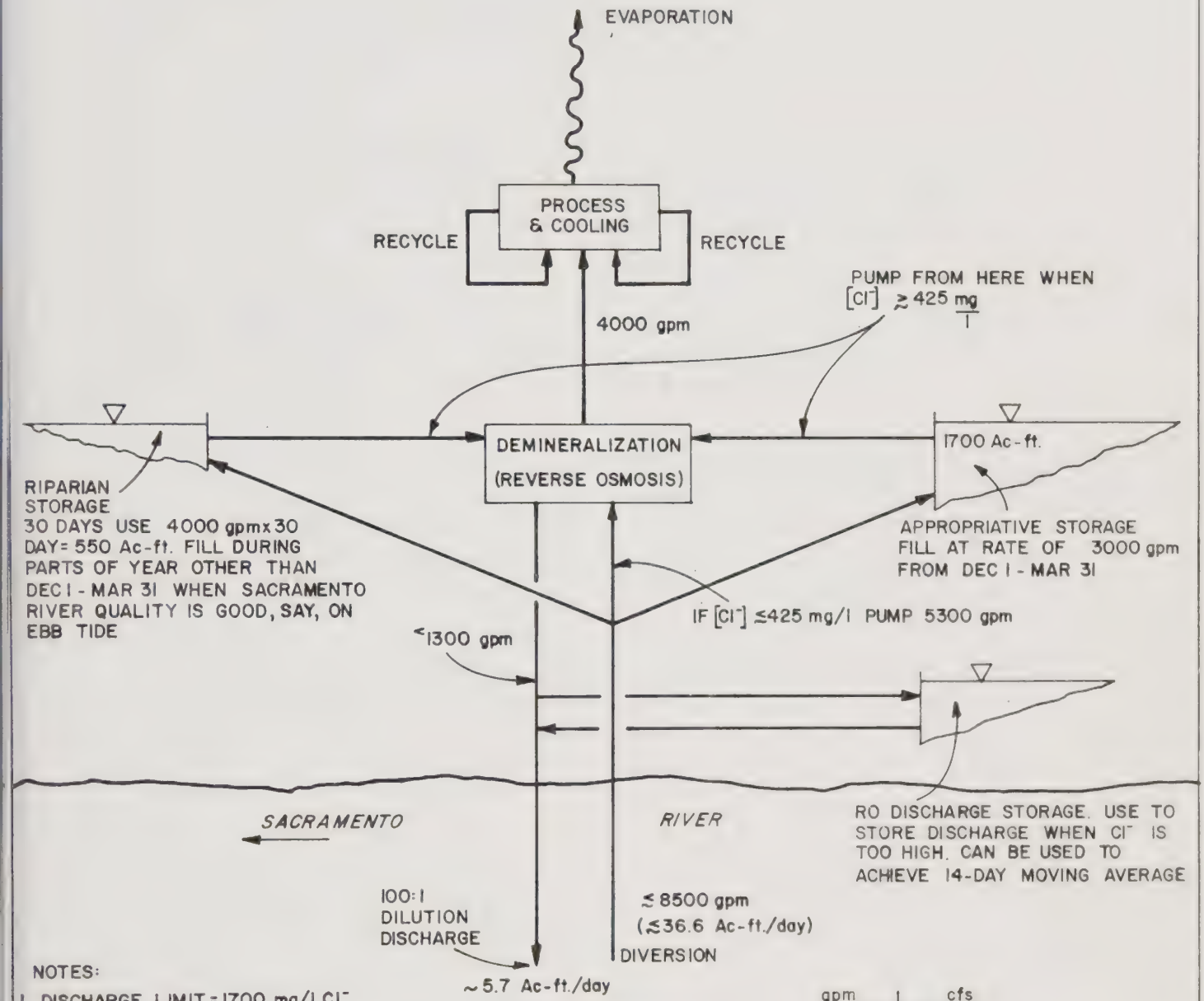
On September 26, 1975, Dow's National Pollution Discharge Elimination System (NPDES) permit for the Montezuma site was adopted by the Central Valley Regional Water Quality Control Board. This permit prohibits the discharge of any water except reverse osmosis reject water. Therefore, the following wastewaters are <u>not</u> allowed to be discharged by the permit: cooling

FIGURE V-1
MONTEZUMA WATER SYSTEM



J.B. Gilbert & Associates - October 1975

FIGURE V-2
DIVERSION-DISCHARGE SYSTEM
MONTEZUMA SITE



NOTES:

1. DISCHARGE LIMIT = 1700 mg/l Cl^- 14-DAY MOVING AVERAGE, (2000 mg/l IN CRITICALLY DRY YEARS) 1000 mg/l FOR 10 DAYS WHEN $[Cl^-]$ CONCENTRATION UPSTREAM AT EMMATON IS ≲200 mg/l
2. $[Cl^-]$ = CHLORIDE CONCENTRATION
   gpm = GALLONS PER MINUTE
   Ac-ft. = ACRE-FEET
   cfs = CUBIC FEET PER SECOND

gpm	cfs
1000	2.2
1300	2.9
3000	6.7
4000	8.9
5300	11.8
6000	13.4
7000	15.6
8000	17.8
8300	18.5

NOTES ON SYSTEM OPERATION
(Refer to Figure V-2)

- From December 1 - March 31, divert ∿8,300 gpm and discharge ∿1,300 gpm with [Cl^-] = 4 times intake concentration
  ∴ net diversion = 7,000 gpm.

- At most other times, divert 5,300 gpm; except possibly on ebb tides divert 8,500 gpm and store up to ∿550 acre-feet in riparian storage. Discharge ∿1,300 gpm with [Cl^-] = 4 times intake concentration
  ∴ net diversion = 4,000 gpm (7,200 on some ebb tides).

- At some times, when [Cl^-] $\gtrsim$425 mg/l, do not divert. Use riparian or appropriative storage. Discharge 1,300 gpm with [Cl^-] <1,700 mg/l, or

  Divert ∿5,300 gpm with [Cl^-] $\lesssim$425 mg/l and intermittently store RO discharge with [Cl^-] >1,700 mg/l to achieve 14-day average concentration of <1,700 mg/l.

- In critically dry years, same as immediately above using 500 mg/l in place of 425 and 2,000 in place of 1,700.

waters, process waters, sanitary wastes, runoff waters, boiler feedwaters, or washdown wastes. The exact wording of the permit is:

"A. Discharge Prohibition:

1. The discharge of any wastes other than reverse osmosis reject water to the Sacramento River or surface water drainage courses is prohibited."

ENVIRONMENTAL IMPACTS OF DIVERSION/DISCHARGE SYSTEM

Description of Units

Salinity can be described in several different ways. The report preparers have chosen not to describe salinity as a percentage of ocean water salinity (which is about 35,000 mg/l TDS) because the project is located in the upper reaches of an estuarine environment which never approaches high ocean levels. Chlorosity is often used as well as TDS (Total Dissolved Solids) to describe the degree of salinity intrusion. Chlorosity is the concentration of chloride ion. Chlorides make up about half the weight of ocean salts, so that chlorisity of 1,000 mg/l is about the same as 2,000 mg/l TDS in the estuarine system. This relationship does not hold true at low concentrations. Electrical conductivity is another method of measuring dissolved salts and measurements of one micromho per centimeter equates to about 0.5 mg/l in TDS.

The highest net diversion (diversion minus discharge) is 7,000 gpm or about 16 cfs which will occur during periods of relatively high Delta outflow. Delta outflow is a calculated rather than a measured number; tidal currents are so large that they mask net outflow, so outflow is calculated from measured or estimated Delta inflows, exports, and consumptive uses. If the maximum net diversion by Dow occurred in combination with the lowest allowable Delta outflow, the net diversion would be considerably lower than the error in the calculation of outflow.

Dow's NPDES permit prohibits the discharge of any water except reverse osmosis reject water; that is, river water whose dissolved minerals have been concentrated by a factor of about four times. Therefore, the net effect to the River would be to evaporate

almost 9 cfs, resulting in a slight increase in dissolved constituent concentrations. This effect was shown in the Draft EIR (Figure V-6) although the abscissa was mislabeled. (The graph should start at 0.0, not 0.1, and continue up to 0.7, not 0.8).

There are also localized effects, near the outfall, of the discharge of water whose constituents are at concentrations about four times that of the River. The proposed outfall will achieve a minimum dilution of 100:1. Therefore, at the outfall, the concentration will be no more than (99 [x] + 4[x])/100 = 1.03 [x]; that is, the maximum increase in the concentration in the River of any constituent will be about 3 percent at the outfall. This is considerably less than the tidal variations in concentrations and should have no adverse environmental effects.

Dow's diversion/discharge system will result in an average net consumptive use of 4,000 gpm (9 cfs). This can be considered as water removed from the California water system, an extensive development of reservoirs, canals, and natural waterways stretching from the Trinity-Shasta complex in the north to San Diego in the south. Any net consumptive use from the system will have an effect, albeit remote, from the point where the diversion and use occurs. The significance of the effect will depend on the time and location of the use and the way the system is operated. For example, if Dow's use is occurring when Delta outflow is 20,000 cfs (roughly, an average outflow), then it could be said that the effect of the consumptive use would occur in the Western Delta but would be insignificant. If, on the other hand, the use were occurring at a time when Delta outflows were near the minimum allowed for salinity repulsion, then, theoretically, the effect could be said to occur at one or more of three general areas:

- If Dow's consumptive use were not accommodated, that is, if no more water is allowed to flow from system reservoirs and if consumptive diversions from the California water system are not reduced, the effect would be felt in the Western Delta, specifically, as a small (less than 0.5%) increase in salinity because of increased intrusion from the Bay due to the Lower Delta outflow.

- If no decrease in Delta outflow is allowed and consumptive diversions are not reduced, the effect will occur as very slightly lower water levels in the system reservoir(s)

and/or transport facilities used to respectively store and convey water to the Delta, or it would occur as a reduction in the time before which additional such facilities would be required.

- If no decrease in Delta outflows is allowed and if no additional releases are made from system storage, then there would have to be a reduction in net consumptive use elsewhere in the system. The environmental effect would depend on when and where the reduction took place.

Reduction in Delta Outflow

The following analysis assumes that the first condition prevails. Figure V-3 shows the effect of Delta outflow on chlorosity at Chipps Island. When high flows prevail (>25,000 cfs), the net diversion will be less than 0.07 percent of Delta outflow. The environmental effect of this downstream would be negligible. Under lesser outflows the effect would be greater and is outlined below for two such conditions:

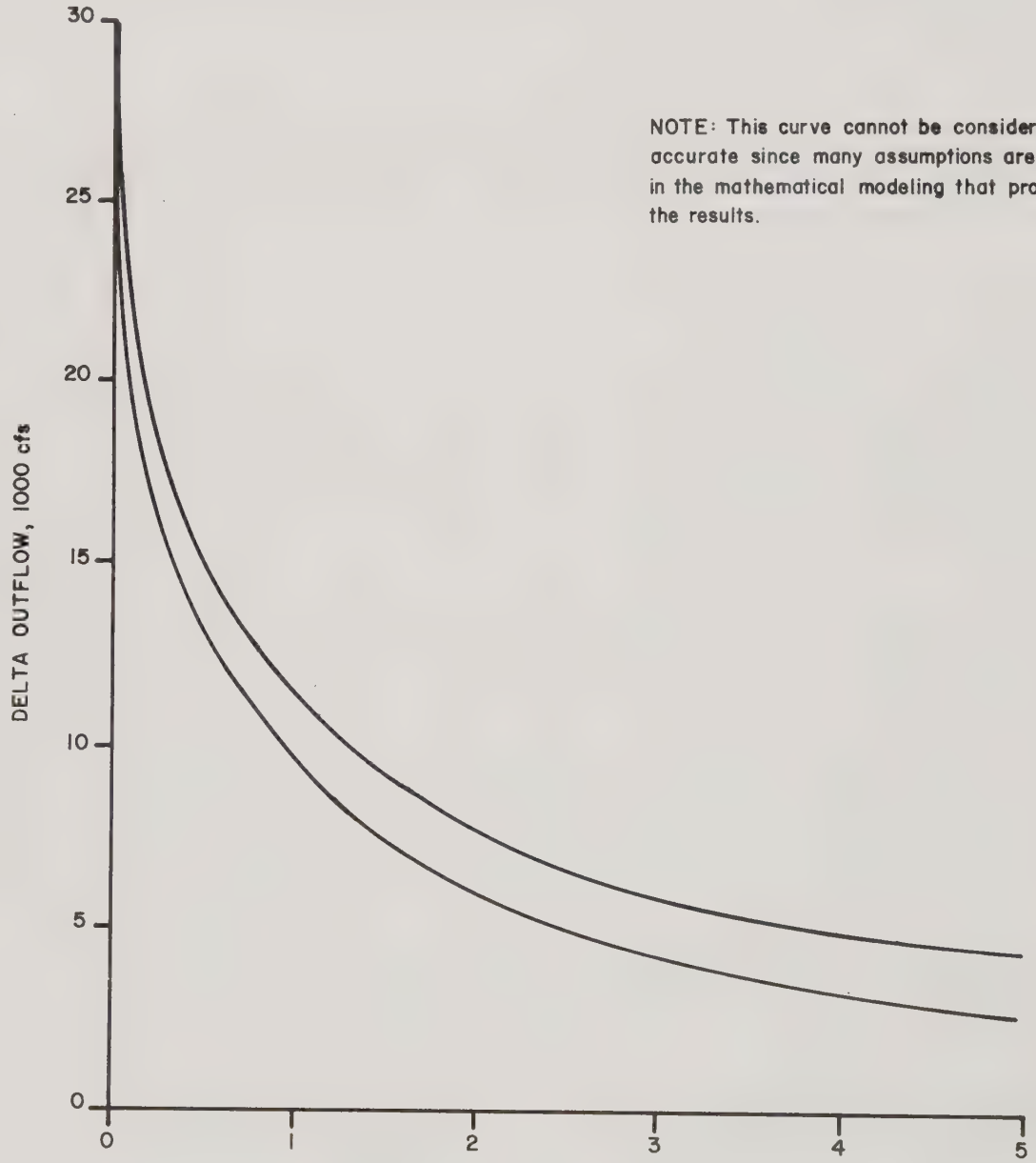
- Late spring conditions (Delta outflow = 15,000 cfs, chlorsity at Chipps Island ≈450 ppm). The effect of a 9 cfs net diversion would raise the chloride concentration about 1 ppm at Chipps Island, or a 0.2 percent increase in salinity.

- Late summer conditions (Delta outflow = 4,000 cfs, chlorosity at Chipps Island ≈ 4,000 ppm). The effect of a 9 cfs net diversion would raise the chloride concentration about 20 ppm at Chipps Island, or a 0.5 percent increase in salinity. Another way of stating the effect is to say that average salinity contours in this region would be moved about 200 to 300 feet upstream. No one can measure this difference under present technology, but theoretically it would occur as a result of the project.

Flora and Fauna Impact

Table V-1 shows the effect of the project on salinity at Chipps Island. Effects on other areas would be proportional. Those species whose osmo-regulatory sensitivity allows them to detect these small changes might move a short distance upstream in order to benefit from the exact salinity desired. Vegetation may be affected in that it does not normally move. A slight

FIGURE V-3
RANGE OF RELATIONSHIP BETWEEN DELTA OUTFLOW
AND CHLOROSITY AT CHIPPS ISLAND



NOTE: This curve cannot be considered highly accurate since many assumptions are included in the mathematical modeling that produces the results.

FROM DATA SUPPLIED IN STATE DWR, PERIPHERAL CANAL EIR

effect could accrue over a long period in that some species of vegetation would find the extra few milligrams per liter of salt adverse, and species movement of a few feet could result. This is all highly theoretical, and in reality, the salinity changes over the year, and between years, are so broad that the effect of the project would likely be insignificant.

TABLE V-1

EFFECT OF PROJECT ON SALINITY AT CHIPPS ISLAND

	Salinities - TDS (mg/l)	
	Without Project	With Project
Medium to High Delta Outflow:		
Chipps Island Average Salinity	600	601
Daily Tidal Variation	200 to 1,000	201 to 1,002
Low Delta Outflow:		
Chipps Island Average Salinity	7,000	7,030
Daily Tidal Variation	5,000 to 9,000	5,020 to 9,040

Effect on Downstream Beneficial Uses

Negligible effect on downstream beneficial uses would result from the salinity changes described. Due to the small salinity impacts of the project negligible impact on fisheries is expected. Water diversions in the Western Delta would experience an increase in salinity on the order of one or two ppm for diversions of 200 to 400 ppm TDS water.

WATER QUALITY STANDARDS IN THE WESTERN DELTA

Table IV-3 in the Draft EIR reviews the applicable salinity criteria in the Western Delta. In addition, Delta water quality standards were recommended in the recent Central Valley Water Quality Control Plan. Heavy metals and chlorinated hydrocarbon levels in the Western Delta violate these recommendations. The diversion-discharge system at Montezuma would provide for a minute increase in these pollutant concentrations, similar to the effects on salinity; that is, all pollutant concentrations would theoretically be increased by the percentages shown before, i.e., anywhere from zero to 0.5 percent.

Water Quality Data Summary

Figure II-10 in the Draft EIR did not contain a legend. This has been added to Figure V-4 herein, and corrections also made in the location of sampling stations.

Compliance with Pollution Control Standards

The Dow plant at Pittsburg has always achieved compliance with air and water pollution regulations and standards before the time they were required. It has meant significant capital and operating expenses for the plant operation and the present effort to eliminate cooling water discharge is evidence of Dow's continuing effort in this area. The plant has had no cease and desist orders issued against it, and no variances are allowed on any regulations. Since 1970, no water pollution citations have been issued, and since 1959, when the Bay Area APCD was formed, only five air pollution citations have been given. The most recent air citation Dow received was due to excessive dust from dragging the infield of the Company baseball diamond. Total plant upset and breakdowns have occurred about once per year on the average, resulting in no significant adverse impact.

EFFECT OF THE DOW PROJECT ON THE STATE WATER PROJECT AND CENTRAL VALLEY PROJECT

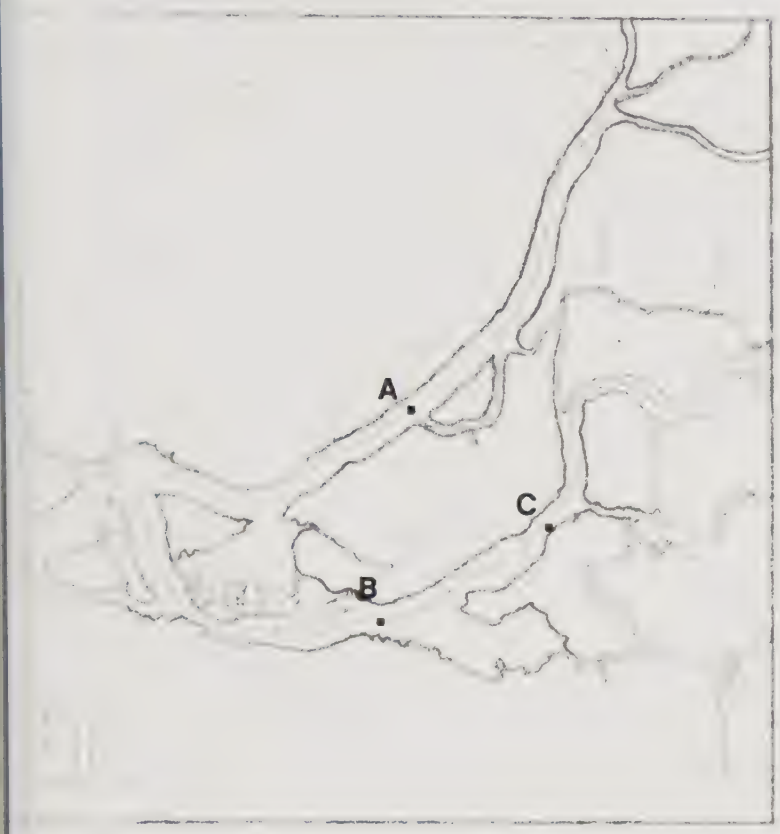
The State Water Project and Central Valley Project could be affected by the need for a slight increase in freshwater releases during some parts of the year.

STATE-SUPPORTED OVERLAND WATER SUPPLY FACILITIES

The State Department of Water Resources has commented that no state-supported, overland facilities would be constructed for Dow because Dow was not "existing" at the time regulations requiring such facilities (as a condition for not meeting some Delta water quality objectives) were enacted. The EIR does not address the question of whether Dow's proposed project will or will not be "existing" relative to the issue of overland water supply facilities. This would appear to be a question of equity. DWR's comment that the definition of "existing" (relative to Dow's proposed project) should be determined is valid only so far as economic rights are concerned. However, the determination need not be made prior to project construction.

Water Quality Data Summary

Figure V-4



A **Sacramento River at Emmaton**

MO	CONSTITUENTS EC	Cl	Na	SO_4	PO_4	N	BOD	CHLR	DO	T	TRB
1	143	6.0	13	—	0.6	0.9	1.6	1.5	11	7.0	48
2	154	6.5	12	—	0.2	0.3	0.8	2.1	10	11	90
3	206	13	15	21	0.2	0.5	1.4	5.8	11	13	26
4	211	1.0	7.3	—	0.5	1.5	0.9	13	10	15	32
5	196	5.3	8.2	—	0.3	1.1	1.0	12	9.5	16	27
6	319	59	61	50	0.1	0.4	1.4	13	9.4	19	24
7	446	15	13	—	0.3	0.5	1.6	26	9.0	23	34
8	354	19	20	—	0.3	0.1	1.0	21	9.1	22	24
9	221	20	38	26	0.2	0.4	1.3	16	8.9	20	22
10	376	119	9.8	—	0.0	0.7	0.9	12	9.5	17	21
11	280	58	—	—	0.1	0.5	1.0	5.5	9.6	12	18
12	190	15	17	12	0.0	0.4	0.7	4.0	11	7.0	25
Min.	92	1.0	7.3	12	0.03	0.1	0.3	1.5	8.1	6.0	11
Avg.	270	31	23	26	0.3	0.6	1.2	13	9.7	17	31
Max.	1250	340	112	50	1.2	1.5	2.6	35	12	24	125
No.	49	32	15	5	20	20	27	29	39	49	39

B **San Joaquin River at Antioch Bridge**

MO	CONSTITUENTS EC	Cl	Na	SO_4	PO_4(1)	N	BOD	CHLR	DO	T	TRB
1	230	15	—	—	—	0.8	2.0	2.6	10	11	68
2	238	17	—	—	0.5	1.1	1.0	2.7	9.7	12	50
3	237	23	19	18	0.3	0.2	1.0	5.9	10	14	25
4	219	22	—	—	0.5	0.6	1.0	11	10	15	35
5	220	26	—	—	0.3	0.8	1.1	22	9.8	18	24
6	690	197	243	65	0.4	0.3	1.9	18	9.2	20	22
7	1106	137	—	—	0.5	0.5	1.6	22	8.6	23	21
8	1030	173	—	—	0.4	0.3	1.2	20	8.2	23	24
9	486	99	108	30	0.3	0.3	1.1	24	8.5	22	21
10	670	143	—	—	0.3	0.3	2.5	23	8.9	18	24
11	435	79	—	—	0.4	0.4	1.8	12	9.5	13	19
12	450	84	42	20	—	0.7	0.9	4.8	11	8.0	15
Min.	120	9.0	16	4.0	0.1	0.02	0.5	2.1	7.3	8.0	11
Avg.	548	95	101	33	0.4	0.4	1.4	17	9.3	18	27
Max.	3120	600	350	80	0.8	1.6	4.2	40	12	25	70
No.	48	42	9	9	24	33	30	40	48	48	47

C **San Joaquin River at Jersey Point**

MO	CONSTITUENTS EC	Cl	Na	SO_4	PO_4(1)	N	BOD	CHLR	DO	T	TRB
1	243	22	23	—	—	2.6	2.0	1.9	10	8.5	55
2	249	20	22	—	0.3	0.9	1.5	2.8	10	11	54
3	232	22	18	25	0.3	0.4	0.9	6.4	10	13	24
4	204	11	9.6	—	0.4	0.5	0.8	10	10	15	34
5	217	16	8.2	—	0.4	0.6	1.3	25	9.9	18	35
6	348	47	50	25	0.6	0.5	1.2	21	8.9	20	34
7	536	93	11	—	0.5	0.6	1.2	27	8.5	23	34
8	428	63	20	—	0.4	0.4	0.8	22	8.6	23	30
9	232	26	28	17	0.4	0.3	1.0	23	8.9	21	22
10	268	37	11	—	0.4	0.3	1.4	20	9.3	18	19
11	263	31	—	—	0.4	0.4	1.5	9.3	9.6	13	18
12	270	32	34	54	—	0.5	1.0	4.9	11	8.0	10
Min.	120	1.0	8.2	11	0.2	0.01	0.2	1.9	6.6	7.0	10
Avg.	309	39	25	26	0.4	0.5	1.2	18	9.3	18	30
Max.	1310	270	122	54	0.9	1.6	2.6	44	12	24	75
No.	86	74	19	9	43	52	51	40	76	85	76

LEGEND

CONSTITUENTS

Q	Flow, acre-ft/mo x 10^3
EC	Electrical Conductivity, μmhos
Cl	Chloride, mg/l
SO_4	Sulfate, mg/l
Na	Sodium, mg/l
HCO_3	Bicarbonate, mg/l
B	Boron, mg/l
NO_3	Nitrate, mg/l
N	Total Nitrogen, mg/l as N, adjusted from $\Sigma[NO_3\text{-}N + NH_3\text{-}N + \text{Organic N}]$
PO_4	Total Phosphate, mg/l as PO_4
	(1) Orthophosphate, mg/l as PO_4
BOD	5 day Biochemical Oxygen Demand, mg/l at 20°C
CHLR	Chlorophyll a, μg/l
DO	Dissolved Oxygen, mg/l
TRB	Turbidity, FTU

MISCELLANEOUS

MO	Month
Min	Minimum Value
Avg.	Arithmetic Average
Max.	Maximum Value
No.	Number of Values included in Average

Additional notes:

T=Temperature, C°

Since each monthly value is an average, the maximum and minimum values do not appear. Only maximum and minimum values over the entire period (1966-1972) of sampling are shown.

Source: Task Order No. II, Comprehensive Water Quality Control Plan for Basins 5A, 5B & 5C, Bay Valley Consultants, May 1973.

PAYMENTS BY DOW FOR PROVIDING SUFFICIENT DELTA OUTFLOW

DWR states that Dow must pay part of the cost of supplying sufficient Delta outflows to maintain water quality standards. This should be a subject for discussion between the Department of Water Resources and U. S. Bureau of Reclamation representatives and Dow as detailed diversion schedules are developed.

EFFECTS OF PERIPHERAL CANAL ON MAINTENANCE DREDGING

DWR states that the peripheral canal diversions will have little measurable effect on existing patterns of deposition. The Dow EIR implies that even if such effects occur, they would not be serious. River currents would serve to reduce any increased tendency to deposition (Page V-50 of the Draft EIR), and if extra dredging is required, its impact would be small (Page V-35 of the Draft EIR). The Peripheral Canal's impact on existing patterns of deposition is therefore not significant to the environmental impact of Dow's proposed project.

ALTERNATIVE SOURCES OF WATER AS MITIGATION

There has been a suggestion by DWR to use reclaimed wastewater as the project water supply. If any source is feasible, it is probably the reclamation plant now under construction by the Central Contra Costa Sanitary District. The CCCSD wastewater effluent is assumed to be discharged to Suisun Bay if not reused. The reclaimed water is estimated to have a total dissolved solids concentration of 550 mg/l so that treatment by reverse osmosis would be required. The discharge would therefore, be similar to the discharge of the proposed system. The river diversion of the proposed system would be eliminated. The net effect relative to the proposed project would be to add about the same amount of dissolved minerals to the California water system but about 9 cfs less water. The discharge of 13.4 cfs of 550 mg/l TDS water into Suisun Bay by Central Contra Costa Sanitary District would be modified to a discharge of 4.5 cfs of 1,650 mg/l TDS water into the Sacramento River. The major disadvantage of this alternative is that reclaimed water would have to be piped across the River from a site about 20 miles from the Montezuma site. There are also higher costs and significantly more energy utilization needs associated with treating and transporting wastewater from Central Contra Costa County.

Other souces of water were investigated throughout project planning by Dow. These are listed below along with the reasons for discarding them.

- U. S. Bureau of Reclamation proposed Montezuma Hills unit of the Central Valley Project. This alternative was rejected since implementation is at least a decade away.

- Irrigation return flows from areas north of the Montezuma Hills. These flows would have to be collected, treated, and transported to the Dow site resulting in extremely high costs.

- Reclaimed wastewater from proposed East Contra Costa Regional Sewage Treatment Plant. This was rejected for much the same reason as CCCSD water.

- On-site well water. Sufficient quantities of water could not be assured and the quality is poor.

COOLING WATER SYSTEM

The use of mechanical draft wet cooling towers at the Montezuma site represents a significant improvement to the water environment by eliminating the large thermal wastewater discharge. Other kinds of cooling systems (natural draft, spray ponds, dry cooling towers) are not competitive cost-wise. Also, land area needs for spray ponds are extensive.

Approximately 100,000 gpm would be recirculating continuously within the various cooling systems at Montezuma. The water would have approximately 2,000 mg/l TDS. Chemicals added to the make-up water would probably include chromate, chlorine, and an acid for slime and pH control. About 3,850 gpm would be evaporated directly from the towers and an additional 30 gpm would leave the towers as a mist. This mist is called windage or drift, and it contains the dissolved material found in the recirculating water. The water evaporated has no impurities, and its impacts are discussed in the section on Evaporation. It appears that there would be no need for blowdown waste since windage results in the entire loss of necessary dissolved solids. A filter would remove any suspended material.

The 30 gpm mist would result in the discharge of about 700 pounds per day of dissolved solids. This material would fall to the ground quickly downwind. Calculations show that the maximum point of mist deposition is approximately 0.3 kilometers downwind, and most of this material will be deposited on Dow property. A small portion would be swept over the property lines with the wind. This could result in some problems and, therefore, as mitigation, these airborne pollutants should be analyzed closely by Air Pollution Control District personnel when evaluating construction approvals for cooling tower systems. Similar operation of the Pittsburg plant, although on a smaller scale, has shown no problems.

IMPACTS FROM EVAPORATION

Large amounts of water are evaporated daily in the Bay and Delta Areas due to the extensive water surface. An area directly south of the Montezuma site (from Collinsville to Emmaton including Lower Sherman Island) contains approximately 10 square miles of water surface. Evaporation from this area amounts to an annual average of 20,000 gpm. Obviously, this is not uniform but varies from zero to over 50,000 gpm on summer days. The impact of an additional 3,850 gpm evaporated from the Montezuma site on a continuous basis will, therefore, have variable effects. During sunny daytime periods, there will be no discernible effects. During nighttime periods in the summer, the relative humidity rarely becomes high enough that the additional water vapor would cause any local ground fog. In winter at night (and early morning hours) and during cloudy or rainy days, when fog has the greatest chance of occurring naturally, the increased vapor from the plant could contribute slightly to local conditions. Plant employees will experience considerable foggy periods in the winter months in any case and must become accustomed to observing careful driving habits.

The interaction of water vapor and mist emissions with other plant emissions is discussed in the section on Air Quality.

SOLAR EVAPORATION PONDS

The Draft EIR stated that 150 acres of solar evaporation ponds would be needed. Further evaluation by Dow staff indicates that only 50 acres of ponds will be required. The annual average evaporation from these ponds will be approximately 150 gpm.

Description of Ponding Operation

It is difficult at this time to express precisely the materials which might be discharged to solar evaporation facilities. When those facilities are designed, they must be classified and receive discharge requirements from the Central Valley Regional Water Quality Control Board. At that time, details will be well-known and other interested public agencies will be encouraged and invited to comment. Certain stipulations, however, are well understood to date. Solar evaporation is a suitable concentration means for removing water from dilute solutions of conservative pollutants. Evaporation is suitable for low concentrations of all sorts of pollutants with extremely low vapor pressures. Solar evaporation then allows the removal of water and hence concentration of the conservative pollutant and salts. Evaporation approaching dryness will result in a concentrated material which can be disposed of in more conventional means (i.e., incineration, recycle, or in a Class 1 disposal site).

At no time would volatile materials be placed in the ponds for disposal purposes. Volatile materials must be removed before wastes are shipped to evaporative ponds in order to prevent air pollution from this type of material. This is a primary mitigation effort to prevent air pollution from evaporative ponds; that is, careful consideration is given to materials entering the ponds and the air pollution potential. Several such ponds are in operation at Pittsburg and an air pollution problem has not been created. The solar evaporation ponds will be classified as Class 1 Ponds and as such are subject to the restrictions applied by the Central Valley Regional Water Quality Control Board and the State Solid Waste Management Control Board.

Process wastewaters will be treated prior to discharge into the evaporation ponds. This treatment will eliminate almost all oily waste or materials which would be likely to result in the coating of the feathers of birds which land on the pond surface.

Impact on Wildlife

Operating experience at the existing Dow plant in Pittsburg has shown that few, if any, birds land on the ponds. The reason for this is unclear, but it would appear that there is some factor, slight odor, or appearance, which deters birds from landing. In the event that substances do enter ponds which could result in injury to birds, an alarm or distress signal should be activated in order to keep birds from landing in the ponds.

In reference to the question by the Suisun Resource Conservation District, the ponds will be placed in areas already filled to the maximum (35-foot elevation) allowed by the U. S. Corps of Engineers dredge spoil easement, so that no conflict in land use is expected. Fencing will be used to minimize wildlife encounters with the ponds.

USE OF WELLS AT MONTEZUMA

A few wells might be utilized at the Montezuma site to supply domestic and sanitary water. A study completed by Woodward-Clyde Associates has determined that the aquifer system underlying the property will not yield sufficient water quantity for entire plant operation, but that a portion of plant needs could be met from this source without causing overdraft conditions. The quality of this water is such that demineralization would be required for drinking water purposes. The wells, if constructed, would probably be located toward the southern part of the property in the alluvial material adjacent to the Sacramento River.

COLLINSVILLE WASTEWATER PROBLEMS

The Solano County Department of Public Health asked if the Montezuma plant might handle sewage disposal problems at Collinsville. A study should be undertaken with possible assistance from the State to determine the best solution to the Collinsville problems. If it is determined that the most cost-effective solution would be for the Dow plant to handle these wastes, that program should be implemented.

DIVERSION STRUCTURE

The water diversion structure in the Sacramento River would be located toward the upstream edge of the property adjacent to the Solano County shoreline. It is important to screen the openings to prevent fish from entering the system. It is also important to keep water velocities across the screens as low as possible to minimize the intake of smaller organisms.

RAINFALL RUNOFF

No discharge of runoff water is allowed by the recent NPDES permit. Subsequent analysis by Dow may show the need for discharge of these waters; however, only nonpolluted waters would be discharged. Dow may need to capture all runoff water in ponds and, after analysis, either treat it and reuse the water or allow it to be evaporated. Possibly, treatment of the runoff water will be needed before it can be placed in evaporation ponds. Runoff water will likely total several hundred acre-feet each season so it is, therefore, an important element in detailed site planning.

All process areas will be diked to capture spilled material as well as rain or wash waters. These waters will be collected, transported to holding ponds, tested, and subsequently treated or used as process water depending upon its suitability. Nonpolluted waters may be discharged.

Rainfall which falls upon petrochemical facilities can become highly contaminated with organic compounds which exert a high chemical oxygen demand (COD). This is particularly true during the first winter rains when the first half-inch or so of rain becomes highly contaminated. As the rainfall season progresses, contamination becomes less significant.

In studies at Texas petrochemical facilities (Engineering Science, 1971) it was found that organic contamination of rainfall was the worst in the tank car loading areas where COD averaged about 5,500 mg/l during the first half-inch of rainfall. Thereafter COD was about 2,500 mg/l up to four inches of rainfall, then declined drastically. Following in the order of magnitude of contamination were the raw material, intermediate product, and finished product storage areas with COD's between 300 and 3,000 mg/l.

Also, the whole range of raw, intermediate, and finished petroleum based materials could be found in runoff waters. Some of these are highly toxic and special safeguards with respect to ponding contaminated runoff will need to be evaluated. Subsequent water quality regulatory requirements will have to deal with these special issues.

TEMPERATURE EFFECTS OF DISCHARGE

No cooling wastewaters are discharged. However, there is a temperature rise in the water going through the pumps, pretreatment facilities, and demineralization units. Much of this heat will be recovered in heat exchange units so that incoming water is preheated slightly. During some periods, storage of raw water and effluent water will result in additional small increments of temperature rise. Generally, total temperature rise (from intake to discharge) is expected to be about 4°F. This additional heat would raise the temperature of the waters around the outfall by about 0.04°F, and, following tidal diffusion, raise the average River temperature at lowest flows by about 0.01°F. There may be times when the temperature rise approaches the 20°F difference allowed in the recently adopted NPDES permit. During such events, River temperatures near the diffuser would rise about 0.2°F and the temperature of the River at lowest flow following dispersion of the discharge would undergo a 0.04°F change. These effects are expected to have no significant impact on the fisheries resource.

A very small effect on Neomysis populations in the vicinity of the outfall could occur if the maximum allowable temperatures were discharged when River temperatures were highest (about 73.4°F). The NPDES permit contains an 86°F maximum temperature discharge. Therefore, the area around the outfall could rise about 0.1°F to 73.5°F and the average River temperature downstream could rise as much as 0.03°F. As pointed out by the Environmental Defense Fund, the existing temperatures of the River water are at the critical point for Neomysis survival, but the effect of the Dow discharge will be extremely small and will not significantly affect the resource.

OIL DISCHARGE FROM BALLAST OF TANKERS

Ballast discharges are prohibited from any ships inside the Golden Gate. Regulating this type of pollution has significantly reduced, but not eliminated, the problem.

DREDGING IMPACTS

The dredging that will be required for construction of docking facilities, the turning basin, and pipelines crossing the Sacramento River will impact aquatic biota. Dredging will reduce

the numbers of benthic biota as well as change the species composition of the benthic community within the dredged areas. After a short period of time (weeks), the organisms killed would reestablish their populations by recruitment from adjoining areas. However, biological diversity may not be restored for some time.

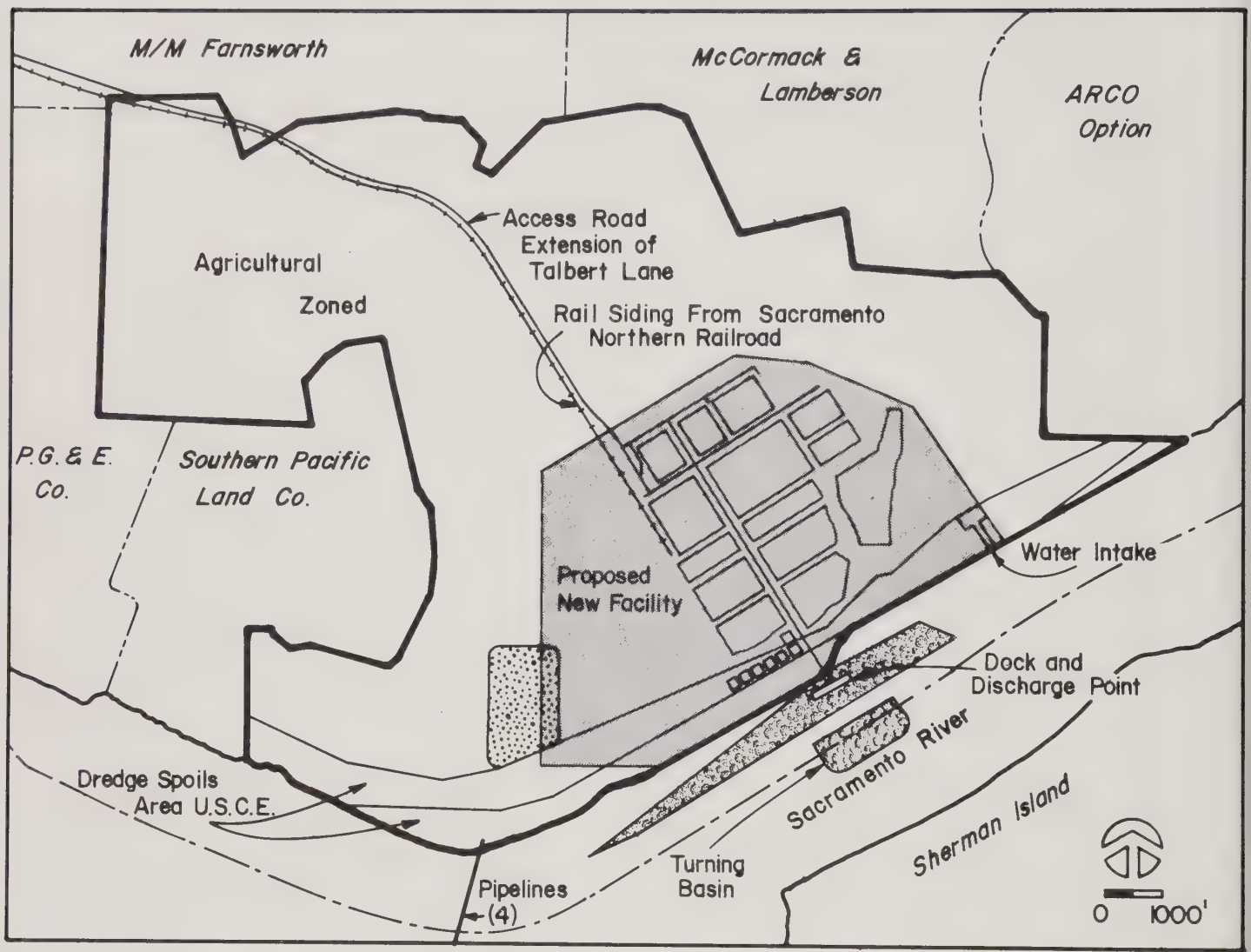
Figure V-5 shows the location of the dock, turning basin, dredging areas, and 50-acre spoils disposal area. A good portion of the Montezuma riverfront has been used as a spoils disposal area by the USCE for channel dredging disposal, and a significant portion has been filled to the 35-foot elevation contour, the allowable height of the USCE easement. Dow would be placing the evaporation ponds and dock access facilities on previously filled areas. The proposed Dow spoils area is also on previously filled land and is not marshland. This disposal site would be used for initial dredging work as well as maintenance dredging. Construction dredging of 500,000 cubic yards would raise the level of the 50-acre site about six feet and annual maintenance dredging of 45,000 cubic yards would raise it about one-half foot per year. Decant water from the spoils site would be settled and the overflow allowed to drain back into the River. Some amount of downward movement of water into the alluvium at the disposal site is possible and this should be monitored for effect on the groundwater, especially if groundwater is used as the drinking water supply.

Some of the River bottom samples analyzed exceeded EPA's criteria for marine disposal of the material. However, Dow intends to dispose of the spoils on land and discharge only decant water. Through the U. S. Corps of Engineers dredging permit process, the Regional Water Quality Control Board will have the opportunity of writing additional permit requirements on that portion of the project.

Detailed dredging schedules have not been developed, but generally June and July would probably be the best months with respect to fish migrations.

Side-casting in the rivers will cause smothering effects. There is the possibility that some other method of temporary storage of dredge spoil material could be utilized while the pipeline segments are being laid in the River bottom. However, this would result in a large increase in costs of placing the pipelines. The limited impact would not seem to justify the large mitigation expenditures.

FIGURE V-5
MONTEZUMA SITE PLAN



Property Lines

Site Boundary Line

Spoil Area 50 Ac

Dredge Area

Rezoning Area

Effects on Zoobenthos

The Delta area where dredging would occur (including Lower Sherman Island) has a bottom fauna characterized by a low species diversity with only a few animals being abundant (California Department of Fish and Game, 1966). Perhaps the most important zoobenthos species in the area to be dredged is the amphipod Corophium stimpsoni which serves as an important source of food for juvenile sturgeon, king salmon, and striped bass. From sampling done in earlier years by the Department of Fish and Game, it was found that the number of Corophium per square foot of benthic surface ranged from 1-280 with a mean number of about 50 for Corophium stimpsoni and a mean of 5 for Corophium spinicorne. The distribution of the two species has been generally found to be related to the predominant sediment type. Corophium spinicorne prefers solid surfaces such as cobble, debris, or gravel, while Corophium stimpsoni were most abundant on substrates of fine sand or a mixture of medium and fine sand.

Effects on Zooplankton

Dredging operations would not have any serious adverse effects on zooplankton in the project area. In the immediate area some zooplanktons may be impacted by dredge material, but it should not adversely effect them any more than through gill irrigation on the crustacean zooplankton.

Effects on Fish

Dredging increases the turbidity of the water and increases the siltation process. Turbidity and siltation and man-induced increases in these two physical processes can directly and indirectly effect fish.

Direct effects include: (1) clogging of gills which inhibits respiratory exchange and (2) abrasive action on gill filaments which damages these delicate tissues.

Indirect effects can include the following:

- Reduced visibility which impairs feeding activity.
- Smothering eggs, food organisms, or spawning areas.
- Creation of anaerobic conditions.
- Absorption and/or adsorption of various chemicals and heavy metals including pesticides which are resuspended in the water.

If carefully performed, dredging will not result in significant increase in background turbidity. Land disposal of dredge spoils will eliminate the adverse effects associated with disposing of dredge spoils in the Ocean or Bay. Impacts of ocean or bay disposal on aquatic biota are significantly greater than the actual dredging impacts and can significantly reduce dissolved oxygen.

EROSION CONTROL

Existing suspended material in the River varies with time of year. During the summer, silt and clay particles are found in suspension, but the primary particles are biological. Algal cell concentrations, mostly diatoms, increase as the spring and summer progresses, raising the turbidity of the waters. As fall comes, these cells do not grow as fast due to reduced light conditions; and runoff from the first rains bring added silt and clay material into the River system. Through the winter, large River flows and higher velocities carry more silt and clay materials in suspension and sandy material moves along the bottom of the River as "bed" load. These high flow conditions usually last well into the spring.

Temporary erosion from exposed fill areas will occur until vegetation has stabilized the slopes. As noted by Mr. Wilcox, of the Suisun Resource Conservation District, immediate revegetating is necessary coupled with covering areas with mulch. Enclosed as Table V-2 are specification sheets submitted by Mr. Wilcox for mitigating erosion potential. These types of soil stabilization procedures should be utilized by Dow in subsequent site planning and construction activities. The Conservation District as well as the Soil Conservation Service are invited to assist Dow in minimizing these soil losses and water quality impacts.

TABLE V-2
EROSION CONTROL SPECIFICATIONS

CRITICAL AREA PLANTING
(With Reseeding Annual Vegetative Cover)

Definition

Controlling erosion on slopes by establishing reseeding annual grass and legume cover.

Purpose

To reduce erosion and sedimentation.

Where Applicable

On denuded, disturbed, cleared areas subject to surface erosion, but stable against slipping and receiving more than eight inches annual average rainfall.

Specifications

1. Site Preparation

   a. Construction operations should be managed so that as much of the area as possible is left in protective cover.

   b. Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulching, and maintenance.

   c. Install needed mechanical practices such as intercepter ditches, berms and terraces, erosion stops, drainage outlets, channel liners and desilting basins.

2. Seedbed Preparation

   a. Areas where straw mulch is to be used and the mulch tucked in mechanically will require seedbed preparation. This may be accomplished by scarifying, disking, harrowing, or otherwise working to a depth of two or three inches.

   b. Where wood fiber mulch is used together with seed and fertilizer, seedbed preparation can be kept to a minimum. Soil surfaces should be left sufficiently roughened to hold hydraulically applied materials on the slope.

3. Fertilization

   Fertilizer should be distributed uniformly over the area to be seeded just before or during seeding. Use a minimum of 500 pounds per acre of 16-20-0, or the plant nutrient equivalent.

TABLE V-2
(Cont.)

4. Seed

One of the following species can be applied:

Elevations to 4,000 Feet

Species	Rate/Acre (Lbs)
Blando Brome	18
Cucamonga Brome	36
Common ryegrass	27
Wimmera ryegrass (Southern California)	27
Lana vetch	45

Lana vetch can be mixed with any one of the grasses by cutting the suggested rate for Lana and the grass in half.

5. Seeding

a. Seed should be uniformly distributed over the area by drilling or broadcasting.

b. On areas where a seedbed has been prepared, seed and fertilizer should be covered with soil to a depth of one-half inch.

c. When seeding with hydraulic equipment, seed, fertilizer, and fiber mulch may be applied together, or in two steps, with the seed going on first, and followed with the fiber mulch and fertilizer. Better seed coverage is obtained by using the two steps.

6. Mulching

Method 1

Immediately after seeding, apply two tons per acre of cereal straw uniformly over the seedbed area. The straw should be held in place on the slope by "punching" or "tucking" or by jute matting, plastic netting, or fiber netting.

Method 2

If wood fiber mulch is used and applied hydraulically, apply at the rate of 1,500 pounds per acre. It can be applied immediately following seeding and fertilizing or applied in a slurry with the seed and fertilizer.

CRITICAL AREA PLANTING -3-
(With Reseeding Annual Vegetative Cover)

7. Maintenance

Maintenance is a vital factor in keeping an adequate vegetative erosion control cover.

Inspect all seeded areas for failures.

Problems may arise in maintaining vegetation on small isolated areas because of repair work, infertile soils, intense shading, sand pockets, bank slips, rodents, or other causes. Failure to immediately treat a small disturbed area can result in its expansion into a more difficult problem.

These areas may require additional seeding and fertilizing.

Periodically broadcast 200 pounds of 16-20-0 per acre uniformly over the vegetated areas between September 15 and November 15. On some sites this may be needed annually. Generally, a fertilizer application every second or third year will help maintain a good protective vegetative cover.

TABLE V-2
(Cont.)

CRITICAL AREA PLANTING
(Establishing Temporary Vegetative Cover)

Definition

Establishing temporary vegetative cover on high silt-producing areas created during construction activities. This includes the seeding of annual grasses, legumes, or grain or the use of anchored straw mulch.

Purpose

To provide rapid cover on disturbed sites for the control of runoff and erosion during construction until permanent vegetation or other stabiliza measures can be established. (This practice is expected to give protecti for a period of six to twelve months.)

Where Applicable

On areas of land that are being converted from agricultural or related uses to nonagricultural development, and when the period of exposure will be at least 60 days, but generally less than 12 months. / If the period of exposure is expected to be over one year, a permanent seeding mixture is recommended.

Specifications

1. Apply and incorporate a minimum of 200 pounds per acre of 16-20-0 or equivalent fertilizer.

2. Seed one of the following mixtures at the rate shown per acre:

   a. September 1 to November 1.

      20 pounds of Wimmera 62 or annual ryegrass.
      100 pounds of barley or

   b. May 1 through July 1 (irrigate for establishment and growth)

      100 pounds of spring oats

   c. May 1 to August 1

      40 pounds of Sudangrass

3. Broadcast or drill seed uniformly and cover ryegrass to a depth of 1/4 inch. Cover other seeds approximately one inch. Seed can be covered and seedbed firmed with a corregated agricultural cultipacker. The cultipacker should be operated across the slope to minimize erosion

4. Temporary vegetative cover can often be satisfactorily established on subsoils of the better agricultural soils without the use of mulch. A mulch is recommended for use on adverse soil conditions.

MARSH PROTECTION

Rather extensive descriptions of regional marsh areas are found on Pages II-43 to II-45 of the Draft EIR. Impacts to the marsh areas are contained within this chapter and the chapter concerning accidental spills. Generally, the operational impacts on marsh areas are expected to be negligible due to the small degree of water quality change.

Mr. Hamilton suggests that increasing chances for fires along Collinsville Road will increase the chance for damaging Suisun Marsh. More traffic would definitely increase the chances for fires caused by careless people. The effects of a fire would cause loss of vegetation and would likely result in increased erosion from the first few rainstorms until new vegetation becomes established. Also, destruction of property from range fires could result.

IMPACT ON PLEASURE BOATING

Pleasure boating would encounter no adverse impacts as a result of the water quality impacts from project operation. If an accidental spill occurred, unsightly slicks of petroleum-based products would produce a significant adverse aesthetic impact. The primary impact on pleasure boating would be plant aesthetics since the closest public views of the plant would be from the Sacramento River itself. Adverse odors may be emitted and the specific impact to boaters would depend on the wind direction. Also, increased shipping in the area could be considered a negative impact to pleasure boating.

CUMULATIVE WATER IMPACTS

All possible water quality impacts are listed below with reference to the significance of each.

Water Quality Impact	Significance
Diversion-Discharge System	Continuous and long-term but probably negligible.
Construction Dredging	Temporary and local impact only. Decant system needs study.
Maintenance Dredging	Annual and local impact only. Decant system needs study.
Erosion from Construction	Temporary and mostly mitigated by special techniques.
Annual Runoff from Plant Sites	Only nonpolluted waters allowed to be discharged.
Fallout from Cooling Tower Drift	Probably negligible but needs detailed study.
Accidental Spills	Highly significant-covered in Chapter XIV.

The cumulative effects of all these impacts are likely to be slight with the exclusion of accidental spills. The impact of a major toxic pollutant spill could have far-reaching effects on aquatic life and other beneficial uses of the Bay-Delta system. For this reason, special attention is given to this type of impact.

MITIGATION MEASURES

The mitigation measures discussed previously in this chapter are listed here:

- No wastewater except reverse osmosis reject water is allowed to be discharged at the Montezuma plant.
- Recirculating flow cooling towers will be used at both plant sites to discharge excess process heat rather than use the River as a heat sink.

- Fish screens, louvres, and other devices as suggested by Department of Fish and Game staff will be used at the River diversion structure.

- More detailed analysis of downwind impact of cooling tower drift should be undertaken prior to construction approvals by the Air Pollution Control District. These studies have not been completed yet due to lack of final design of cooling towers.

- Evaporation ponds will have a double seal to insure no escape of water into the soil.

- Additional certification of the ponds will have to be made prior to construction approval.

- A system to scare birds away from the ponds should be installed and utilized whenever necessary. Ponds shall be carefully fenced to avoid wildlife contact.

- Decanting at the spoils disposal site shall be closely monitored for groundwater pollution.

- An additional NPDES permit may be needed for rainfall runoff discharge and for dredging spoils decanting.

- All nonplant site runoff will be intercepted and conveyed around the developed area to River discharge.

- Reverse osmosis reject water will be run through a heat exchanger with incoming water to extract most of the heat buildup encountered through the reverse osmosis units.

- Initial dilution of reverse osmosis reject water will be about 100 parts River water with one part waste discharge. This system will involve an outfall diffuser underneath the dock with several discharge ports jetting the reject water into the River for quick dilution.

- Erosion control practices suggested by the Suisun Resource Conservation District will be followed closely and Dow staff must work with District and SCS personnel, if necessary, to minimize soil losses and water quality impacts.

Hazardous Wastes VI

CHAPTER VI

HAZARDOUS WASTES

Comments were received from numerous individuals, environmental groups, and regulatory agencies requesting additional information with respect to hazardous wastes generation, handling, and disposal.

GROUP 1 WASTES

Solid, semisolid, or liquid wastes which constitute a high degree of hazard to beneficial water uses are classified by the State Water Resources Control Board as Group 1 wastes. These wastes which are noxious and normally excluded from normal waste disposal processes, must be disposed of in specific locations and under special precautions. A description of solid and liquid waste classifications is shown in Table VI-1.

INDUSTRIAL WASTES

Certain industrial waste materials may be toxic, corrosive, irritants, strong sensitizers, flammable, explosive, infectious, or radioactive. Human contact with hazardous industrial wastes is routinely accomplished in facilities such as the Dow project, but only under the safest conditions using protective equipment. Design of any chemical manufacturing facility takes into account the nature and potential hazard of the chemicals involved, in this case a wide variety of basic petrochemicals. Additional contact can occur during storage, transport, and disposal of any unusable residue or waste associated with a particular manufacturing process. Hazardous industrial wastes (Group I wastes) are normally disposed on land in designated areas known as Class I disposal sites. These sites must meet very stringent criteria established by the State Water Resources Control Board which are summarized in Table VI-2. These Class I sites are selected only after studies have shown that no hazards will exist or be created for persons, animals, plants, or the environment in the surrounding area and most importantly, that there will be no pollution of ground or surface water associated with disposal at the proposed site.

TABLE VI-1

DESCRIPTION OF SOLID AND LIQUID WASTE CLASSIFICATIONS

Group 1	Group 2	Group 3
Consist of or contain toxic substances and substances which could significantly impair the quality of usable waters. Examples Include: . Saline fluids from water or waste treatment processes. . Community incinerator ashes . Toxic chemical toilet waste . Industrial brines . Toxic and hazardous fluids . Pesticides or chemical fertilizers or their discarded containers . Other toxic wastes	Consist of or contain chemically or biologically decomposable material which does not include toxic substances nor those capable of significantly impairing the quality of usable waters. Examples Include: . Garbage . Rubbish . Construction debris such as paper, cardboard, rubber, etc. . Refuse such as yard clippings, litter, glass, etc. . Dead animals . Abandoned vehicles . Sewage treatment residue such as solids from screenings and grit chambers, dewatered sludge, and septic tank pumpings . Infectious materials from hospitals or laboratories	Consist entirely of nonwater soluble, non-decomposable inert solids. Examples Include: . Construction and demolition debris, asphalt paving, inert plastics, etc. . Vehicle tires . Industrial wastes such as clay products, glass, slags, tailings, etc.

Source: State Water Resources Control Board, Administrative Code, Title 23, Subchapter 15, Article 3

TABLE VI-2

CLASSIFICATION OF WASTE DISPOSAL SITES

Class I	Class II	Class III
Class I disposal sites are those at which complete protection is provided for all time for the quality of ground and surface waters from all wastes deposited therein and against hazard to public health and wildlife resources. The following criteria must be met to qualify a site as Class I: (a) Geological conditions are naturally capable of preventing vertical hydraulic continuity between liquids and gases emanating from the waste in the site and usable surface or groundwaters. (b) Geological conditions are naturally capable of preventing lateral hydraulic continuity between liquids and gases emanating from wastes in the site and usable surface or groundwaters, or the disposal area has been modified to achieve such capability. (c) Underlying geological formations which contain rock fractures or fissures of questionable permeability must be permanently sealed to provide a competent barrier to the movement of liquids or gases from the disposal site to usable waters. (d) Inundation of disposal areas shall not occur until the site is closed in accordance with requirements of the regional board. (e) Disposal areas shall not be subject to washout. (f) Leachate and subsurface flow into the disposal area shall be contained within the site unless other disposition is made in accordance with requirements of the regional board. (g) Sites shall not be located over zones of active faulting or where other forms of geological change would impair the competence of natural features or artifical barriers which prevent continuity with usable waters. (h) Sites made suitable for use by man-made physical barriers shall not be located where improper operation or maintenance of such structures could permit the waste, leachate, or gases to contact usable ground or surface water. (i) Sites which comply with a, b, c, e, f, g, and h but would be subject to inundation by a tide or a flood of greater than 100-year frequency may be considered by the regional board as a limited Class I disposal site.	Class II disposal sites are those at which protection is provided to water quality from Group 2 and Group 3 wastes. The types of physical features and the extent of protection of groundwater quality divides Class II sites into the two following categories: Class II-1 sites are those overlying usable groundwater and geologic conditions are either naturally capable of preventing lateral and vertical hydraulic continuity between liquids and gases emanating from the waste in the site and usable surface or groundwaters, or the disposal area has been modified to achieve such capability. Class II-2 sites are those having vertical and lateral hydraulic continuity with usable groundwater but for which geological and hydraulic features such as soil type, artificial barriers, depth to groundwater, and other factors will assure protection of the quality of usable groundwater underneath or adjacent to the site. The following criteria must be met to qualify a site as Class II: (a) Disposal areas shall be protected by natural or artificial features so as to assure protection from any washout and from inundation which could occur as a result of tides or floods having a predicted frequency of once in 100 years. (b) Surface drainage from tributary areas shall not contact Group 2 waters in the site during disposal operations and for the active life of the site. (c) Gases and leachate emanating from waste in the site shall not unreasonably affect groundwater during the active life of the site. (d) Subsurface flow into the site and the depth at which water soluble materials are placed shall be controlled during construction and operation of the site to minimize leachate production and assure that the Group 2 waste material will be above the highest anticipated elevation of the capillary fringe of the groundwater. Discharge from the site shall be subject to waste [illegible]	Class III disposal sites are those at which protection is provided to water quality from Group 3 wastes by location construction, and operation which prevent erosion of deposited material.

Source: California Administrative Codes, Title 23, Subchapter 15; Article 2.

There are many industrial wastes which are considered hazardous. These may consist of wastes which are the residues from a particular process, sludges from treatment processes, material obtained during cleanup of a spill or operational upset, or wash water from tank cars or other transportation vehicles.

Typically, industrial wastes can be grouped into the following general categories:

Sludges
Solvents and Paints
Caustics
Acids
Water and Washes
Chemicals
Oils
Pesticides, Resins, and others

Within the San Francisco Bay Area, there are three designated industrial waste disposal sites which have obtained the necessary certification from the various State agencies so that they may receive and manage industrial wastes. These three Class I sites are:

1. Pacific Reclamation and Disposal, Incorporated, owns and operates a 278-acre site approximately three miles north-northeast of Benicia.

2. Industrial Tank Company's Vine Hill-Martinez site located approximately three miles southeast of Pittsburg on Paso Corte Road.

3. Richmond Sanitary Service Disposal Site located northwest of Richmond on Garden Tract Road one block south of Parr Boulevard.

The Dow Chemical Company will contract with Industrial Tank Company and/or Pacific Reclamation and Disposal, Incorporated, for disposal service.

Estimated Class I Wastes from Proposed Project

Class I wastes from the proposed project are difficult to estimate since they are the result of tank and deck washings which normally will be treated and recycled to the process. It

is postulated that occasionally heavy (difficult to burn for energy content) oils or difficult to break emulsions will be transported to appropriate Class I disposal sites for controlled incineration. The expected quantities involved will be less than 5,000 barrels per month and probably less than 2,000 barrels per month including the water content of the washings (the water content will likely average about 75 percent of the total). Existing Class I sites at Benicia and Martinez have sufficient capacities to handle the projected quantities as are indicated in the attached letters from the companies operating these sites.

HANDLING OF HAZARDOUS WASTE MATERIAL

Hazardous wastes are defined in Section 25117 of the California Health and Safety Code. Within most chemical production facilities, substances included in the list of hazardous materials are routinely handled with few major mishaps. Stringent Federal and State as well as The Dow Chemical Company, regulations and policies control the handling and disposal of hazardous wastes.

Extremely hazardous waste disposal requires written approval of the State Health Department at least 15 days prior to disposal. Also Section 60134(c) of the Administrative Code (Title 22, Division 4, Chapter 4) specifies that in the event of an emergency, accident, or disaster which results in the need of immediate processing or disposal, the 15-day notification is waived. The Department of Health should be notified immediately, however. Prior to disposal, hazardous waste mixtures must be tested and the analytical data submitted to the Department of Health for determination as to whether the mixture is hazardous.

Hazardous waste haulers carrying materials to a certified Class I site must maintain records required by the State Water Resources Control Board. Fees required by Section 25174 of the Health and Safety Code must be collected by the Class I site operator. These fees based upon the volume of material disposed are subsequently paid to the Hazardous Waste Control Account of the State General Fund.

There will be some waste materials generated at the new facilities which are defined as hazardous waste. All handling and disposal operations dealing with these wastes will be carried out in accordance with the State Department of Health regulations. This will include stringent characterization and reporting as

required by the Department and submission of a State fee for wastes that are delivered to a Class I site. It is anticipated that further more stringent regulations will apply to these types of materials before they are actually generated by this project proposal. Those more stringent regulations will also be followed as they apply.

HAZARDOUS WASTE IMPACT

The average chemical waste production rate of 1,000 pounds per day may be low for a complex of this size and complexity. However, it is anticipated that new technology, newer processes, and newer recycling means including incineration for heat recovery will help minimize the quantity of waste down to an irreducible amount. Larger waste volumes may result from tank washings, equipment cleanout, and the like. In these cases, fairly large volumes of water with small quantities of waste will be the rule. These wastes are generated in such a way that they are immediately contained in tank car or holding tanks prior to the application of on-site or off-site disposal techniques. Some heavy metal sludges will be generated from cooling tower operations utilizing chromate or other heavy metal corrosion inhibitors. These sludges will be drummed for disposal in Class 1 sites or recovered for metal values. Special wastes, of a chemical nature as of yet undefined, will require special handling, storage, and treatment operations which will be designed in detail as the wastes are specified in final design. Such activity is subject to review by the Department of Health through Cal OSHA.

TRANSPORT OF WASTE MATERIALS

Transport of waste materials within the site would be done by piping operations. Since most "waste" materials are in fact downgraded raw materials which have further utilization, this is the appropriate method of transfer. Materials which will leave the site are in two categories: The first catagory is rubbish, debris, paper waste, and the like which will be transported to an off-site Class 2 disposal area. This type of waste is normally handled in large, solid debris dumpster boxes which are covered before transfer off site. This mode of transportation is anticipated for both sites. A second type of waste would be Group I type materials in low volumes which would be transported off site either packaged in drums as solid or semisolid or as cleanouts or washings in tank trucks.

MITIGATION MEASURES

- The facilities that should be designed will include the newest, most up-to-date technology available for use in the petrochemical industry at the date of their final design and installation. Bearing this in mind, detailed information on waste generation from currently operating, perhaps very old plants, will not be a valid data set for new and modern facilities. This assumption regarding new technology has been used throughout the EIR.

- The Dow Chemical Company should stringently adhere to all existing and future regulatory and industry criteria related to the handling, storage, transport, and disposal of all solid waste materials.

- Where outlets or markets exist, materials suitable for recycling should be utilized to the fullest extent possible.

- In-plant recycling should be incorporated into the design of the plants to maximize the utilization of natural resources.

REFERENCES

California Department of Public Health, "Hazardous Waste Disposal Survey, 1971", California Solid Waste Planning Study, 1972.

California Department of Public Health, "Guidelines for Hazardous Waste Land Disposal Facilities". 1973.

California Administrative Code, Titles 22 and 23.

PRD INC.
PACIFIC RECLAMATION
AND DISPOSAL, INC.
P.O. BOX 885 • BENICIA, CA 94510
(415) 228-5100
24 HOUR SERVICE

September 29, 1975

J.B. Gilbert & Associates
1101 R Street
Sacramento, CA 95814

Re: Draft Environmental Impact Report, Dow Petrochemical Project.

Gentlemen:

In support of the Draft Environmental Impact Report, I would like to comment on the proposed disposal procedure for Group I wastes discussed on page V-36.

We own and operate a Class I waste disposal facility on 278 acres off Lake Herman Road near Benicia. This facility would be able to receive most types of Group I wastes produced by the indicated project. We would be able to handle approximately 7,000 barrels per month and would be willing to work with Dow to develop further capacity if necessary. In order to ensure our capability to receive the wastes, we would request that information as to the chemicals to be disposed of be made available when they are known.

Thank you for the opportunity to present this information and if there are further questions I will be happy to supply additional data.

Very truly yours,

B.L. Simonsen

B.L. Simonsen

BLS:nd

INDUSTRIAL TANK, INC.

310 BERRELLESA STREET
P.O. BOX 831
MARTINEZ, CA. 94553

"24 HOUR SERVICE"
(415) 228-5100

September 29, 1975

J.B. Gilbert & Associates
1101 R Street
Sacramento, CA 95814

Re: Dow Petrochemical Project, Draft Environmental Impact Report

Gentlemen:

I would like to submit comments on the Draft Environmental Impact Report pertaining to the disposal of Group I wastes.

1. The Antioch Class I site has been shut down and is not available for Group I wastes. It is being operated by GBF, Inc. currently as a Class II site only.

2. Industrial Tank, Inc. owns and operates a Class I Treatment Plant and disposal facility near Martinez which handles a great variety of Group I wastes from many refineries and chemical plants. This facility could handle the indicated volume of up to 7,000 barrels per month of wastes subject to review of the chemical makeup of the waste stream. If necessary, disposal could be designed and built by our staff to further treat the material for incineration or disposal.

If you have any questions, please contact us at 415-228-5100. I would like to commend you on a complete and well documented report.

Very truly yours,

Barney Simonsen

Barney Simonsen
Vice President

BLS:nd

Planning VII

CHAPTER VII

PLANNING

A number of the planning aspects of this project have been discussed in the various response sections, particularly those on growth inducement and the Williamson Act. Additional comments were received regarding the extent of planning for potential industrial development in Southeastern Solano County, inaccuracies in the Draft EIR with regard to the status of planning in the vicinity of the Pittsburg facility, the need to relate the Association of Bay Area Government's (ABAG) Regional Plan to the proposed project, and the availability of alternative sites.

SOLANO COUNTY

The Southeastern Solano County General Plan--1990 dated December 1973 identifies a deep-water port facility in the vicinity of Collinsville for handling bulk material transfers. The land use map for the area also shows industrial development taking place on the McOmie property. This is shown conceptually, but there is no detailed discussion of industrial development and only a general discussion of environmental impacts.

Section 2 of the Plan indicates that "industrial land use requirements may change towards bigger sites and fewer workers per gross acre than presently. The rate of scientific and technological advance effecting industrial production processes will continue at a high level," and "greater awareness will exist for the need to study living organisms in their specific environment and their effects on each other. Adequate planning for fish and wildlife needs--also for recreation industry purposes--will be fully recognized."

Section 3 of the Plan entitled Objectives and Principles summarizes the work of eight citizens committees. The Agriculture and Industry Committee concluded "that area roughly bounded from Rio Vista west along Highway 12 to Shiloh Road thence south to Collinsville and then east to Rio Vista along the Sacramento River; that said area that is presently zoned Industrial remain so and that that area presently zoned A-20 remain so." The Committee also recommended that (1) major areas of first class

agricultural land be reserved for that use, (2) contiguous areas for industrial use should be planned in excess and excluded from open lands provisions, (3) that the Sacramento River frontage in the Collinsville area should be used for water-oriented industries only, and (4) industries should be allowed direct access to the waterfront even at the risk of interfering with recreation-oriented activities like fishing and hiking.

The General Planning Policy Committee recommended that "the present Collinsville Industrial Area be left undisturbed but provisions be made for future industrial zoning north along the present railroad only as development demands."

The General Plan--1990 contained an environmental impact report which was prepared in accordance with State guidelines. The report, although brief and general, dealt with most of the significant issues raised in the current EIR process. Under the section entitled The Growth-Industry (sic) Impact of the Proposed Action, "The expressed policy in this plan document is to provide areas for manufacturing industry and recreation industry." The Plan's EIR also states,"Together with the Collinsville harbor development goes BCDC's adopted plan for water-oriented industries. Each specific industry applying for a permit to operate has to develop an Environmental Impact Report and at that time each specific application must be evaluated in relation to mitigation of any potentially adverse effect on the natural environment."

Actions of PG&E in continuing its applications for the construction of a power facility at Collinsville and ARCO in acquiring an option to purchase property immediately east of the Montezuma site indicate a reliance on the General Plan--1990 and indicate that the economic factors support the industrial intentions adopted by the County.

Given the level of development proposed during the time of Plan preparation, the Plan provides a general guide that reflects the County and local policy at that time. Although greatly limited in detail, it provides coverage of most of the major environmental factors being considered in the Dow project. The Plan and its EIR's intention that each specific project be subject to detailed analysis regarding specific environmental impacts is currently being carried out in this EIR and responses and in the numerous permit activities presently underway.

A potentially significant adverse impact would result from the development of scattered residential areas in the southeast portion of the County. The Solano County Planning Department staff has reemphasized the County's basic policy to limit urban growth only to incorporated cities. At the present time, all but 8 percent of the County's population resides in incorporated cities. If the Dow facility or other proposed industrial developments take place, there will be pressure for the development of mobile home parks, rural subdivisions, and support facilities such as gas stations, stores, and service facilities in the vicinity. This could tax existing road capability; create waste disposal problems; require major water supply facilities in the event local groundwater sources prove to be inadequate either in quality of quantity; add burdens on the school transport system for the River-Delta School District; and cause other problems related to the development of scattered urban areas.

Solano County has shown an interest in and a willingness to allow major industrial development, both with access to shipping and inland. The County's policies as well as Contra Costa's favor the location of industry despite increasing concern about potential environmental effects.

CONTRA COSTA COUNTY

Although development of Dow's Pittsburg plant site is controlled by Contra Costa County's 1963 Land Use and Circulation Plan, background data utilized in Chapter III, Social and Economic Characteristics, in the Draft EIR were obtained from the recently (April 1975) adopted City of Antioch's General Plan. However, during the review process, it was suggested that the EIR discuss the controlling land use plan (i.e., Contra Costa County's 1963 Land Use and Circulation Plan and the recent amendments included in the 1973 Open Space Conservation Plan).

In addition to the County General Plan, general plans relating to the areas in the vicinity of the Pittsburg site are:

Pittsburg. The 1960 Master Plan, as adopted by both the Planning Commission and the City Council, along with subsequent amendments (to 1968) form the basis for land use planning in the Pittsburg area. The Land Use Guide Plan adopted by the City Planning Commission in September 1973 indicates current land use and is intended as a guide for future development. It has not yet been adopted by the City Council.

Antioch. The Antioch General Plan, adopted in April 1975, is not a precise plan, but rather a policy plan which sets forth a series of written statements that define the direction and character of future development and establishes the actions necessary to attain the desired development. Unlike a detailed plan which shows the exact land use pattern to occur, the General Plan indicates the general location of land uses and their interrelationships to policy. In short, it constitutes an expression of policies (i.e., goals, objectives, standards, and principles) as a basis upon which detailed development decisions and specific land use proposals can be made.

Contra Costa County General Plan

The Dow Chemical Company presently operates a chemical production facility near Pittsburg in the unincorporated part of Contra Costa County. The site is bounded by New York Slough on the north, the US Steel and Continental Can Company facilities on the west, the Stauffer Chemical Company facility on the south, and the City of Pittsburg's Camp Stoneman Sewage Treatment Plant and undeveloped land on the east. About half of Dow's 500-acre site is currently developed. It is anticipated that the new Dow facilities would be constructed on the remaining 250-acre parcel adjoining the existing production facilities. (Figure I-8 in Draft EIR) The proposed site for expansion is surrounded by vacant land on two sides, industry on the third, and water (New York Slough) on the fourth side.

The proposed expansion site is located in an unincorporated area planned for heavy industrial development under the Contra Costa County Land Use and Circulation Plan. This designation is compatible with the general plans of the urban areas in the immediate vicinity of the site, Pittsburg, and Antioch.

Adjacent Land Plans

The Pittsburg planning area includes about 1,470 acres (including streets, utilities, and rail facilities) which are used for industrial purposes; this represents almost 11 percent of the total planning area. Heavy industrial manufacturing areas are generally located between State Highway 4 and the waterfront. West of the Black Diamond residential neighborhood, the

industrial area extends from Willow Pass Road north to the waterfront. East of that neighborhood, the industrial area extends from Highway 4 to the waterfront. Lighter industrial uses are shown on the City's General Plan in the Camp Stoneman area and in the easterly portion of the planning area between the Southern Pacific Railroad tracks and State Highway 4.

Of the land in the Antioch general planning area, about half is vacant and one quarter is "resource-agriculture." Other significant uses are residential, park, and recreation. Most of the industrial development occurs in areas parallel to rail transport facilities and in the southwest corner.

The proposed site is in an area of existing heavy industrial use. The land to the east is mostly vacant, with the exception of a PG&E substation and existing Dow facilities. The area to the west is fairly well saturated with heavy industry; The Dow Chemical Company, Stauffer Chemical Company, US Steel Company, and Continental Can Company all have plants near the site. An area to the east of the site on the banks of New York Slough, along with Browns and Winter Island, has been designed as marshland open space areas in the County Land Use Plan.

Future Land Use

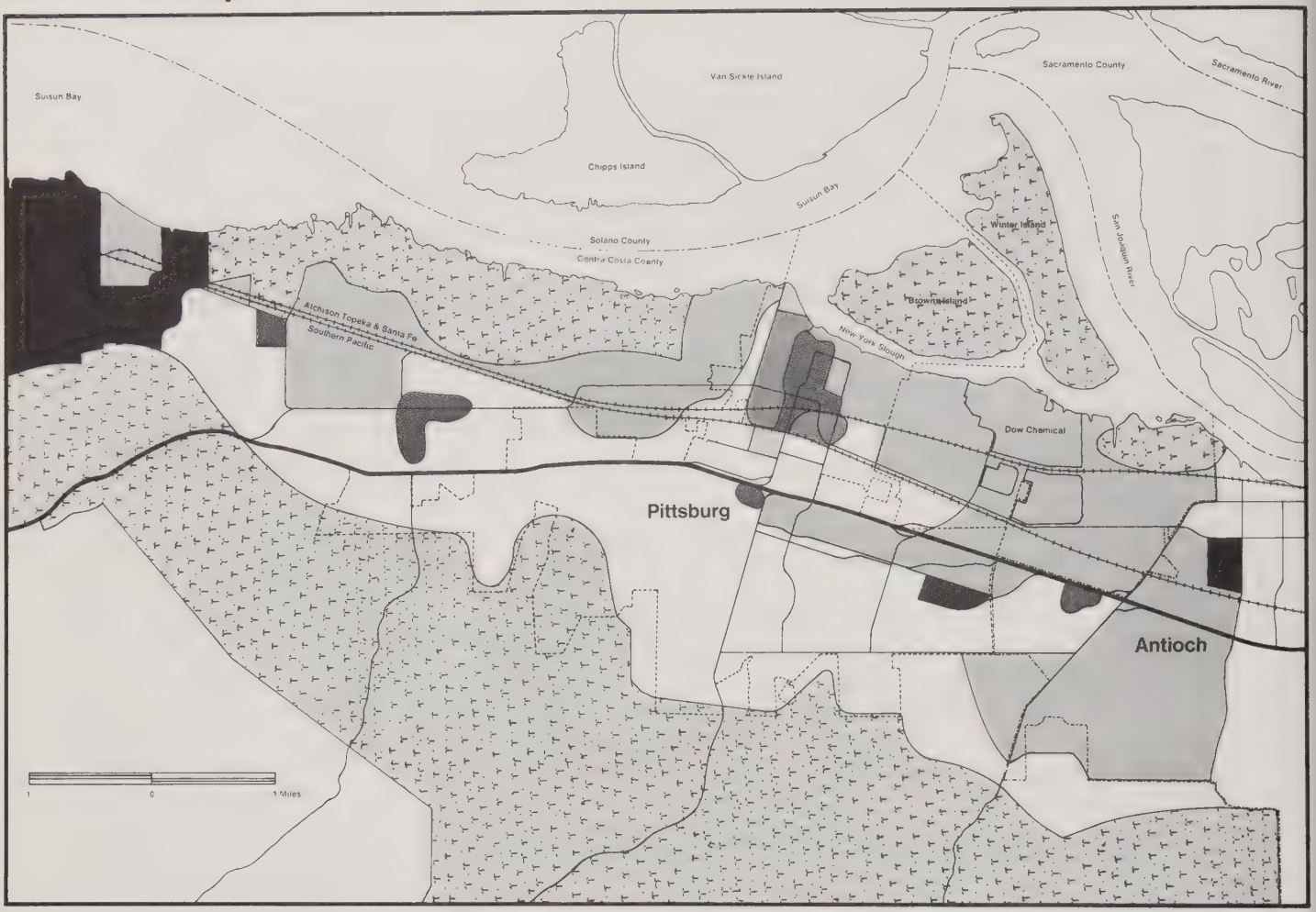
The land use plan shown on Figure VII-1 is based on the County's plan. It is meant as a guide for commercial, industrial, and residential development that will fulfill the long-term needs of the County. The plan reflects the goals of the urban areas in the vicinity of the Pittsburg site: to maintain a balance of compatibility in land uses both within neighborhoods and with adjacent areas and to protect and enhance open space areas as a valuable community resource.

With a few exceptions, medium, high density, and multiple family developments will be within or very near to the urban centers and the industrial areas where employment will be found. Open spaces, including parks, golf courses, woodland, range land, marshlands, and wherever possible, the best agricultural lands are to be preserved. The major area of agricultural activity is proposed to be the large, productive, high-quality soil farm land in the eastern part of the County.

Large commercial centers provide the residents of the various parts of the County with adequate major shopping centers and

Land Use Map

Figure VII-1



Residential

- Single Family
- Multiple Family

Service & Employment

- Commerce
- Industry

Public & Related

- Public & Semi-public
- Open Space
- Pittsburg City Limits
- Antioch City Limits

related facilities integrated with the proposed major routes of circulation. Industrial development will roughly parallel the rail transport facilities and the San Joaquin River area. This is the general area where light and heavy industries are already located.

The site of the proposed expansion has been designated for use by heavy industry. The land to the east has also been classified as such while the area just south of the Pittsburg-Antioch Highway has been designated as a light industrial park area. Liberal use of open space will create a buffer between the industrial development, transportation facilities, and residential areas.

SACRAMENTO COUNTY

The pipelines connecting the two sites and ship traffic will take place in Sacramento County, and the County could be affected by emissions or spills as discussed in other responses. Western Sherman Island is in Sacramento County and is designated recreational in the 1973 County General Plan. The County's zoning ordinance permits pipelines delivering gaseous materials in recreational-zoned areas. Sherman Island is owned by the State of California and administered by the Department of Fish and Game who will control the conditions of the pipeline crossing and has already indicated the mitigation measures they require. During the construction of the natural gas pipeline along the westerly edge of Sherman Island, a use permit was obtained from Sacramento County and various approvals were also obtained from the Corps of Engineers (Permit No. 90231), the State Lands Commission, the Reclamation Board, the Regional Water Quality Control Board, and the Department of Fish and Game.

REGIONAL PLANS

The location of major industrial facilities has a significant impact on regional planning. There are a limited number of deep-water access sites in the Bay Area and such special resources as the Suisun Marsh and the Delta have significant regional, if not national, environmental values. The Federal Government in acting on all permits and applications for various types of financial assistance has insisted the projects be consistent with regional planning goals. This approach was further strengthened

in the recent Federal "208" water quality planning program for the Bay Area to be conducted by ABAG, the State Air Quality Maintenance Plan, and other regional environmental management programs.

The ABAG Regional Plan 1970:1990 provides the regional framework for assessing the proposed facilities. Tables VII-1, VII-2, and VII-3 give some indication of the anticipated level of economic development.

The location of the economic growth is discussed in the Plan as follows:

> "Given the present composition of the region, the vast majority of new employment opportunities is expected to occur as an expansion of already existing centers. Where possible, basic industry tends to locate close to well developed utility, trade, and transportation facilities and near the existing labor force. (Development in new areas has been stimulated by the growing scarcity of land in the region's older industrial centers.) In Santa Clara County, growth in the technologic industries is expected to be a continuing stimulus for development. These industries are also expanding in central Alameda and Contra Costa counties, and will contribute to the development of the Pittsburg-Antioch area as well as that of southern Solano County."

The Plan's statement of regional goals are sufficiently broad to encompass most proposals including the subject facilities. However, in order to achieve these regional goals, it will be necessary to assure that no new separate residential communities develop, and that employment serve to strengthen the city-centered regional concept. In addition to the goals of assuring environmental quality, providing adequate shelter, transportation and open space and a sense of regional identity, the goals include the designation of ample land and facilities for economic growth of the region. In the Plan's emphasis on guiding regional growth, the general growth corridors outlined in the Plan provide the basis for redevelopment of existing communities, planned expansions at the edges of existing communities, planned new communities, and "greatly expanded existing smaller communities." If the various recommended mitigation measures are followed, the proposed project should result in development that is consistent with these concepts of guiding regional growth.

TABLE VII-1

EMPLOYMENT IN MAJOR ECONOMIC SECTORS

Employment Category	1960	1970	1980	1990
Agriculture	35,800 2.5%	27,400 1.4%	19,400 0.8%	15,100 0.5%
Mining	2,300 0.2%	2,500 0.1%	2,800 0.1%	3,200 0.1%
Construction	96,400 6.7%	121,300 6.1%	146,700 5.8%	171,000 5.5%
Manufacturing	294,700 20.4%	374,300 18.7%	447,500 17.6%	547,300 17.6%
Transportation, Communication and Utilities	119,900 8.3%	142,000 7.1%	161,900 6.3%	185,400 6.0%
Wholesale and Retail Trade	305,500 21.7%	404,000 20.2%	472,400 18.5%	549,600 17.6%
Finance, Insurance and Real Estate	88,500 6.1%	133,800 6.7%	183,000 7.2%	230,700 7.4%
Services	260,500 18.1%	413,000 20.7%	569,300 22.4%	730,600 23.4%
Government	238,700 16.6%	380,600 19.0%	542,600 21.3%	681,300 21.9%
Total Employment	1,442,300 100.0%	1,999,100 100.0%	2,545,600 100,0%	3,114,300 100.0%
Basic, or Site-Oriented Employment	684,800 47.5%	921,400 46.1%	1,144,300 45.0%	1,410,600 45.3%
Population Serving Employment	757,500 52.5%	1,076,800 53.9%	1,401,300 55.0%	1,703,700 54.7%

Source: ABAG Regional Plan 1970:1990, July 1970.

TABLE VII-2

EMPLOYMENT IN BAY REGION COUNTIES

County	1960	1970	1980	1990
Bay Region	1,442,300	1,998,100	2,545,600	3,114,300
Alameda	352,600	466,100	594,300	724,500
Contra Costa	103,500	153,000	212,500	271,200
Marin	32,800	62,200	76,700	100,000
Napa	18,600	28,900	43,100	56,600
San Francisco	476,200	541,500	592,900	714,100
San Mateo	131,200	234,300	303,900	362,800
Santa Clara	228,000	389,500	549,600	665,500
Solano	53,000	62,100	80,700	109,200
Sonoma	46,400	61,500	91,900	110,400

Source: ABAG Regional Plan 1970:1990, July 1970.

TABLE VII-3

EMPLOYMENT GROWTH RATES BY DECADE
1960-1990, BAY REGION AND COUNTIES
(in percentages)

County	1960-1970	1970-1980	1980-1990
Bay Region	28.5	27.4	22.3
Alameda	32.2	27.5	21.9
Contra Costa	47.9	38.8	27.6
Marin	89.5	23.3	30.4
Napa	55.3	49.2	31.2
San Francisco	13.7	9.5	20.4
San Mateo	78.6	29.7	19.4
Santa Clara	70.9	41.1	21.1
Solano	17.2	29.9	35.3
Sonoma	32.5	49.5	20.3

Source: ABAG Regional Plan 1970:1990, July 1970.

The Plan's policy guidelines that are particularly pertinent are:

City-Centered Region

"Living, working, and shopping within the same community should be planned and promoted by all levels of government and the private sector. To make this possible, a wide range of well-serviced residential units convenient to urban centers of employment will be required. The need for long commuting should be reduced."

Community Development

"Controlled development areas should be located around the urban fringe of each community to provide, if needed, holding zones to permit the orderly extension of urbanization or the creation of new communities. Land scheduled for early use should be released in units of neighborhood size or larger, and unified planning and design concepts should be applied in order to prevent wasteful, unattractive, and ecologically damaging scattered development."

The principal emphasis of the ABAG Plan is on residential development. Concerns for urban sprawl and the serious problems it creates in areas of transportation and air and water quality were primary factors in development of the Plan. The Plan deals only in a limited and indirect way with the problems of major industrial development in the Bay Area.

ALTERNATIVE SITES

The "best alternative" site in Pittsburg and alternative sites have been the subject of discussion in correspondence between the Attorney General's office and the Contra Costa Planning Department and the subject of comments.

Comments on alternative sites center on the US Steel property adjacent to the existing Dow facility. This would be a better location for the proposed expansion, thus avoiding river crossings and delaying development of a new industrial area. As previously stated, the industrial development in Southeastern Solano County has been contemplated for some time. Most commentors have not objected to industrial development per se but rather insisted that that development be properly planned and that all adverse impacts

be stated and mitigated. During the early planning phases of the petrochemical project, Dow entered into negotiations with representatives of U. S. Steel in an attempt to secure a portion of that company's holdings. These negotiations lasted over a period of several months and resulted in a refusal by U. S. Steel to sell the property.

The extent to which Dow "should have" pursued acquisition of this site raises a public policy question regarding the appropriateness of alternatives to a proposed private development. Private companies do not have the power of eminent domain as public agencies do and hence an unrestricted approach to the selection of the "best" alternative is not possible. In this case, Dow, as evidenced by correspondence, did enter into negotiations and did in fact suspend planning work on the development of the Solano site late in 1974 when it appeared possible that some agreement might be reached with U. S. Steel. Dow's decision to accept the disadvantages of operating at two locations is not likely to have been made if the adjacent land were available with its obvious economic, environmental, and management advantages.

As indicated in the summary on mitigation measures, the additional future effort with regard to public planning for development in Southeastern Solano will be extensive, including additional technical study, planning, and transportation improvements.

If U. S. Steel proceeds with its development plans in Contra Costa County and other industries expand at a normal rate, it is reasonable to assume that all of the presently unused industrial land with access to port facilities will be developed in Contra Costa County in the near future. When the limited amount of land which has access to deep-water ports is considered, and it is assumed desirable to develop those lands that have the shortest ship travel, first, it becomes a matter of timing which is influenced by regional and local governments and by the nature of private property transactions.

MITIGATION

- To assure that the plans of Solano County are consistent with the regional goals and objectives, it would be desirable to strengthen planning ties between Solano County, Contra Costa County, Sacramento County, ABAG, and other

agencies undertaking single-purpose regional planning. This need not require a formal institutional arrangement, although it may be desirable. Joint task forces working on specific plan elements might be a satisfactory way to assure cooperative planning.

- Mitigation measures for growth inducement and the Williamson Act involve planning issues, particularly the need for effective detailed planning for industrial development in Southeast Solano County.

Transportation VIII

CHAPTER VIII

TRANSPORTATION

Most comments requested more information on road impacts and mitigation measures. The following aspects of circulation and access as related to the proposed Montezuma Hills site will be discussed:

- Existing conditions of State and local roads that presently provide access to the site.
- Current and projected traffic on these roads, with and without the proposed Dow project.
- Impacts associated with projected traffic.
- Road maintenance and capital costs.
- Measures to mitigate the impacts during construction and operation of facilities.

EXISTING ROAD CONDITIONS

State Highway 12, which links Fairfield and Rio Vista and continues east to Lodi, is the most heavily used roadway providing regional access to the Montezuma site. A description of the general condition of the section between Fairfield and Rio Vista is included in Table VIII-1. County roads presently providing local access to the Montezuma site area are indicated on Figure VIII-1. They extend south from Highway 12 and join the Collinsville Road, which continues south and leads to Talbert Lane. The present conditions of these roads are described in Table VIII-2.

TRAFFIC

Current traffic information for State Highway 12, including count and vehicle mix information is included on Table VIII-3. As indicated, a high percentage of the traffic on the section between Fairfield and Rio Vista is through-truck traffic. In

TABLE VIII-1

STATE HIGHWAY 12: FAIRFIELD - RIO VISTA

Segment	Fairfield Area-Denverton Road[1]	Denverton Road-Currie Road	Currie Road-Azevedo Road	Azevedo Road-Rio Vista Area
Direction	East	East	East	East
Approximate Mileage	9 miles	8 miles	2 miles	3 miles
Width	40 feet; two 12-foot lanes (heavy section) and two 8-foot shoulders	Original 15-foot width later widened to 21-22 feet; graded dirt shoulders	Same as Fairfield-Denverton Road segment	Same as Denverton Road-Currie Road Segment
Thickness (Heavy Sec.) AC[2]	0.33'	Original 15'x5" Portland concrete cement section (reinforced with steel) later widened to 22' with 8" URB;[5] overlay: 4" AC x 22'.	0.45' (Type B)	Same as Denverton Road-Currie Road segment
Thickness (Heavy Sec.) AB	0.67'[3]		0.5' (Class 2)	
Thickness (Heavy Sec.) ASB	1.0'[4]		1.55' (Class 4)	
Comments	Segment built within last 10 years; passing lanes at some intersections.	Road generally in better condition west of Collinsville intersection; shoulder edges overgrown with grass some areas on 2 mi. segment between Collinsville Road and Birds Landing Road intersection with Highway 12.	Segment built within last 5 years.	

[1]East of Southern Pacific Railroad Crossing.
[2]AC=asphalt concrete surface; AB=aggrebate base; ASB=aggregate subbase.
[3]UB=untreated base; roughly equivalent to AB under new classification system.
[4]ISM=imported subbase material; roughly equivalent to Class 4, ASB.
[5]URB=untreated rock base.

FIGURE VIII - I
LOCAL COUNTY ACCESS ROADS



0 2
MILE

DOTS INDICATE ACCIDENT LOCATIONS: 1970-1975

TABLE VIII-2

PRESENT CONDITION OF ACCESS ROADS FROM HIGHWAY 12 TO SITE

Road	Segment	Direction	Mileage	Pavement Width	Width Unpaved Shoulder	Thickness[1]			Surface Condition	Shoulders Condition	Comments
						AC	AB	AS			
Shiloh Rd	Highway 12-Collinsville Rd	S	6.39	20'	5'	0.25'	0.25'		Generally good New seal coat: 5/16" rock and oil (1975).	Loose gravel in general with some patches of grass. Widths vary 2' to 8' often unequal. Slope off abruptly some areas.	Small bridges at 2.3 & 3.7 mi. Too narrow for 2 trucks to pass. Irrigation ditch crossing at 0.6 mi & numerous pipe crossings restrict width. 90° turn followed by dip at S.N.R.W. crossing (5.1-5.2 mi) forms hazardous section. Sight distance limited by curve at 1.2 mi.
Collinsville Road	Highway 12-Shiloh Road	S	3.64	14' (unpaved)	2'	0	2"		Loose gravel and dirt	Edges overgrown with grass some areas.	Rolling hills. Curves at 0.9 & 1.1 mi. Have limited sight distance.
	Shiloh Road-Birds Landing Road	S	0.82	22'	6'	0.3'		0.3'	Generally good	In good condition	No significant hazards. A few crossings indicated by markers.
	Birds Landing Road-Talbert Lane	SE	2.8	21'	7'	0.8'		0.45'	Significant cracking in some areas, filled potholes, better near Talbert.	Areas where shoulder width narrow.	Hilly, curves. Bridge & pipe crossings restrict width.
Birds Landing Road	Highway 12-Montezuma Hills Road	SW	4.59	20.5'	5'	0.15'	0.75'		First 2.6 mi good condition (recently sealcoated); balance shows some cracking.	Loose gravel, grass some sections.	
	Montezuma Hills Road-Collinsville Rd	W	1.54	20.5'	5'	0.1'	0.25'		Has some cracking	Grass shoulder some sections.	Curves, especially at 1.3 mi, limit sight distance.
Talbert Lane	Collinsville Rd -End	E	2.4	6' (unpaved)	7'	0	5"		Unpaved, narrow. Not adequate for truck traffic.		Curves

[1]AC=asphalt concrete surface; AB=aggregate base; AS=aggregate subbase.
[2]Lime treated base.

TABLE VIII-3

1974 TRAFFIC VOLUMES
HIGHWAY 12

Highway 12 Junction with:	1974			% Truck 1974-1980
	Peak Hour	Average Daily Traffic		
		Peak Month	Annual	
	2,000	19,000	17,000	6
Fairfield, Pennsylvania Street	1,700	15,700	14,000	5
Fairfield, Union at Texas	1,200	10,100	9,000	5
SP Railroad Crossing	750	6,500	5,800	5
	660	6,200	5,500	8
Scandia Road (to Travis AFB)	380	3,600	3,200	14
Junction Route 113 North	530	4,550	3,800	14
Rio Vista (Drovin Drive)	600	5,200	4,300	13
	890	7,900	6,600	13
Rio Vista West Junction Route 84				

Source: CALTRANS 1974 traffic projection. Figures shown above breakpoints apply to highway immediately back of breakpoint. Figures below apply immediately ahead of breakpoint.

the Fairfield area, trucks are routed through the Union and Texas intersection and continue on West Texas through the center of Fairfield. Recent traffic count data on selected Solano County roads are included in Table VIII-4. These roads are lightly traveled by passenger traffic and occasional agricultural, heavy-load vehicles.

TABLE VIII-4

TRAFFIC COUNTS ON SOLANO COUNTY
ROADS IN VICINITY OF SITE
(24 Hours, 1972 at Selected Dates)

Location	Number of Vehicles
Creed Road	22
Lambie Road	77
Goose Haven Road	52
Little Honker Bay Road	27
Shiloh Road	147
Hopkins Ravine Road	25
Collinsville Road	201
Birds Landing Road	122
Montezuma Hills Road (near Rio Vista)	234
Currie Road	39
McCloskey Road	46
Azevedo Road	32
Liberty Island Road	458
Airport Road	572
Church Road	394
Ryer Road East (near Ferry)	252

Source: Solano County Department of Public Works.

Traffic projections for Highway 12, with and without the Dow project, are shown on Table VIII-5. The assumptions made for traffic patterns are indicated in the footnotes to the table. Truck traffic during construction is estimated at 15 trucks per day, the majority between the Fairfield area and the site. Average daily passenger traffic estimates during the construction and operation phases are approximately the same. Since Highway 12 is designed to withstand heavy truck traffic, the impact during construction of the employee and truck traffic on structural sections of the highway will not be significant.

TABLE VIII-5

1980 TRAFFIC PROJECTIONS
HIGHWAY 12[1]

Highway 12 Junction with:	Without Dow		With Dow			
			Construction[2]		Operation	
	Peak Hour	Average Daily Traffic Annual	Peak Hour	ADT Annual	Peak Hour[3]	ADT Annual[4]
Fairfield, Pennsylvania Street	2,600	21,500	2,700	21,700	2,660	21,700
Fairfield, Union at Texas	2,100	17,700	2,200	17,900	2,160	17,900
SP Railroad Crossing	1,500	11,400	1,800	12,000	1,680	12,000
	950	7,300	1,250	7,900	1,130	7,900
Scandia Road (to Travis AFB)	840	7,000	1,140	7,600	1,020	7,600
Junction Route 113 North	490	4,100	790	4,700	670	4,700
Rio Vista (Drovin Drive)	670	4,800	820	5,100	720	5,000
	760	5,400	910	5,700	810	5,600
Rio Vista West Junction Route 84	1,160	8,300	1,210	8,400	1,180	8,400

[1]CALTRANS traffic projections. Figures shown above breakpoints apply to highway immediately back of breakpoint; figures below apply immediately ahead of breakpoint.

[2]Assume 300 workers from Fairfield-Suisun area, 100 from Rio Vista, 50 from beyond Rio Vista. Of Fairfield-Suisun passenger traffic, assume about 1/3 use Union-Texas intersection. Truck traffic distribution: 10x2=20 through Fairfield-Suisun; 5x2=10 through Rio Vista; assume no truck trips during peak hour; truck traffic routed through Union-Texas intersection.

[3]Assume 75 percent of total peak hour trips (about 230 during 4-6 pm) to Fairfield-Suisun area, remainder to Rio Vista and beyond. Of trips through Fairfield, about 1/3 use Union-Texas intersection.

[4]Assume employee commute pattern: 300 from Fairfield-Suisun area, 80 from Rio Vista, 30 from beyond Rio Vista; no shipments by truck anticipated.

With regard to the Fairfield area, the major portion of peak-hour congestion now occurs at the Union-West Texas intersection. Other routes to the downtown area that avoid this intersection are available to passenger traffic; however, truck traffic through the area is presently routed through this intersection. Since this situation is not expected to be changed in the near future, any extra vehicles will contribute to existing congestion, noise, and safety problems. If the commute assumptions are correct and no ferry service is provided from Contra Costa to the site, the project will increase peak-hour Highway 12 traffic east of Fairfield by 10 percent.

Contacts have been made with Fairfield police, City Traffic Engineer of Fairfield, and Vallejo Highway Patrol. Most responses to requests for information regarding the impact of the proposed traffic volumes were general in nature and it was difficult to determine if the police authorities involved felt that the traffic volumes would have any significant effects.

The county roads in the vicinity of the site are currently lightly traveled, and traffic is not projected to increase unless current land use patterns are altered. The projected traffic with and without the Dow project is shown on Table VIII-6. These roads will deteriorate under the estimated passenger and truck traffic that will be generated during the construction period. They are maintained for the current light, local traffic and agricultural loads; pot holes and cracked sections are resurfaced as needed. Since the majority of passenger and truck traffic will be generated in the Fairfield-Suisun area, the Shiloh-Collinsville Route south from Highway 12 will be the most heavily used route to the vicinity of the site until the proposed new access route (Collinsville Road south from Highway 12) is completed. The Birds Landing-Collinsville Route would probably be used by traffic from Rio Vista and beyond.

The present condition of the Shiloh-Collinsville-Talbert Route as shown on Table VIII-2 indicates that these roads are not designed to handle the traffic projected to travel to and from the site during the construction period. The pavement surfaces are variable: 0.25 feet AC (asphalt concrete) along Shiloh Road; 0.3 feet AC on Collinsville Road from Shiloh intersection south to Birds Landing; 0.08 feet on Collinsville Road from Birds Landing south to the vicinity of Talbert Lane. Talbert Lane, composed of five-inch aggregate base, is inadequate to carry heavy truck loads. The pavement width along the two-lane route averages about 20 feet. Shoulders are unpaved; and

TABLE VIII-6

1980 TRAFFIC PROJECTIONS
SOLANO COUNTY ROADS

Road	Segment	Average Daily Traffic[1]			
		Without Dow	With Dow[2]		
			Passenger	Truck[3]	Total
Shiloh Rd.	Highway 12-Collinsville Rd.	150	750	20	770
Birds Landing Rd.	Highway 12-Collinsville Rd.	120	420	10	430
Collinsville Rd.	Shiloh Rd.-Talbert Lane	200	1,100	30	1,130

[1] Numbers rounded to nearest 10.
[2] Assume 300 workers from Fairfield-Suisun area use Shiloh-Collinsville route; 150 from Rio Vista and beyond take Birds Landing-Collinsville route.
[3] Truck estimates: 15 trucks per day; 10 through Fairfield, 5 through Rio Vista area.

although the average shoulder width along the route is reported to be 6 feet, there are sections along Shiloh Road where the width is less than 2 feet; shoulder width varies greatly along the entire route. Other potentially hazardous situations include: narrow bridges with guard rails set so that two trucks would have difficulty passing and curves and ungraded sections where sight distance is limited.

ACCIDENTS

Accident information for Solano County Roads in the vicinity of the Montezuma site is shown on Figure VIII-1. Accident locations are indicated by dots for the 1970-1975 period. The increase in traffic projected for these lightly traveled roads would probably lead to increased accident rates, even with necessary road improvements.

Information regarding accidents on the portion of State Highway 12 between Fairfield and Rio Vista for 1973 is shown below:

1973 ACCIDENT DATA: STATE HIGHWAY 12

Segment	Mileage	Total Accidents	Average Daily Traffic (ADT)	Comments
Fairfield - Denverson Road	5.7	13	3,000	Rolling hill and range terrain; low lying fog areas.
Denverton Road - Rio Vista	13.5	29	4,000	Rolling hill and range terrain; narrow shoulders; infrequent passing lanes; few sharp curves; abrupt hills; violations for speed and improper passing most common on this segment.

Source: Vallejo Highway Patrol

Additional traffic generated during construction and operation of Dow facilities, about 1,100 and 820 ADT respectively, would have a minor impact on these statistics.

PHASE I ROAD IMPROVEMENT AND MAINTENANCE

It is not anticipated that the additional traffic generated by the facility at Dow will require extra maintenance or input expenditures on Highway 12 either during construction or operation (CALTRANS). County road needs will result in improvement and maintenance expenditures. Estimates for these costs are shown in Table VIII-7.

TABLE VIII-7

ROAD MAINTENANCE AND CAPITAL COST
ESTIMATES FOR COUNTY ROADS
(Based on Solano County Estimates)

	Annual Maintenance Cost, $	Capital
Phase I		
Overlay Interim Access Route (Shiloh-Collinsville)	20,000	217,000
New Road - Talbert Lane (Proposed Dow Transport Corridor)	4,000	1,000,000
Maintain Easterly Access Route (Birds Landing Road From Highway 12 to Collinsville Road Intersection	13,000	
Future		
New Road (Collinsville Rd. between Hwy. 12-Talbert Ln)	18,000	3,500,000

The majority of passenger and truck traffic during the construction period will use the Shiloh-Collinsville-Talbert Route to the site. The County Public Works Department has estimated that these roads will need to be resurfaced and maintained to handle increased traffic loads. Their initial estimate of the overlay cost for the 6.3 mile length of Shiloh Road is $140,000. They have also estimated that resurfacing the portion of Collinsville Road between Shiloh Road and Talbert Lane would cost about $77,000. The cost of upgrading Talbert Lane to carry the projected traffic volumes during construction and operation is estimated at about 1 million dollars. Estimates of the annual maintenance costs for this route are about $2,000 per mile for a total of about $24,000 including the Talbert Lane portion. The annual cost of maintaining the easterly access route (Birds Landing Road from Highway 12 to intersection with Collinsville Road) is estimated at about $13,000.

The actual rate of increase of traffic on Collinsville Road, the phasing of individual construction activities, the results of proposed transportation planning studies, and possible negotiations between Dow and the County regarding road maintenance cost responsibilities all affect timing and magnitude of Phase I improvements on the access routes to the project site.

FUTURE ROAD NEEDS

Collinsville Road, part of the FAS (Federal Aid Secondary) road system, has been proposed by the County as the local access corridor from Highway 12 to the site. If a new two-lane road is required, it would consist of a 40-foot wide paved road with two 12-foot lanes and two 8-foot shoulders. It is anticipated that it would take two to three years to complete the new route: one year for right-of-way acquisition, and one to two years for construction.

Assuming the completion of a new road which would follow the general direction of the existing Collinsville Road south from Highway 12 to the vicinity of Talbert Lane, the capital cost, including right-of-way acquisition and construction, is estimated at about $3.5 million ($500,000 per mile for the seven-mile route to vicinity of Talbert Lane). Maintenance costs during operation of this facility are estimated at $18,000 per year; this figure includes cost of maintaining Talbert Lane segment.

The County Public Works Department has estimated that this road should be in operation by the time Dow's facilities are operational. This road will obviously have great benefits to other industrial zoned land in the area and should be planned as part of the general transportation improvements to the area. Alternative methods of financing such improvements, as well as the initial resurfacing project, include special agreement between Dow and the County, the use by the County of additional tax revenues that could be directly or indirectly obtained from the Dow project, or formation of an improvement district that included other industrial zoned property.

MITIGATION MEASURES

Phase I - During Construction

- As a minimum, additional maintenance effort should be undertaken as soon as site operations begin. Maintenance operations should begin on the Collinsville access route as soon as construction operations begin.

- The County in cooperation with Dow should work out a schedule for road surfacing improvements considering Dow's plans regarding Talbert Lane improvement as well as the near-term needs of other properties in the area.

- Sheriff and Highway Patrol authorities should be asked to develop any additional measures required as a result of the anticipated peak construction traffic.

- Attention should be given to schedule construction shifts in a way that would minimize peak traffic on the Collinsville Road, and the weight and size of delivery trucks should be carefully analyzed to determine road impact as material shipments are scheduled.

Future - During Plant Operations

- At some point in the future it will be necessary to rebuild the Collinsville Road. The date should be determined as the result of a proposed transportation study to be undertaken by the County, giving consideration to other industrial demands in the area and the rate of construction by Dow of individual plant units and associated employment.

- Dow should give consideration to the establishment of a ferry service as discussed under planning aspects to reduce traffic loads on the project and possibly delay the need for Phase I or future improvements.

- Maximum use of carpooling would reduce peak traffic volumes. Company vans and shift scheduling are possible techniques that would reduce traffic volumes.

- The size, type, and frequency of truck deliveries to the site can affect road maintenance and improvement needs. These factors should be considered when scheduling truck traffic.

Wild Life &
Vegetation IX

CHAPTER IX

WILDLIFE AND VEGETATION

INTRODUCTION

Since the original Draft EIR was printed, additional vegetation and wildlife surveys have been completed in order to assess seasonal variations in the species present and the differences in abundance during different times of the year. These findings are contained in this chapter along with additional discussion of the impacts on vegetation and wildlife written in response to comments received on the Draft EIR.

Additional descriptions of the various areas which are likely to be impacted by the proposed project are included. Supplementing these descriptions are more extensive listings of the plant and animal species actually observed or likely to be found in the environs of the proposed project.

Following these descriptions are the additional assessments of the impacts on biological resources resulting from construction and operation.

The species lists contained in this chapter were compiled by undertaking field surveys (which were conducted from February 21 through August 22, 1975) as well as published lists of the California Department of Fish and Game, Native Plants Society, and National Audubon Society. The studies will continue through the fall months of 1975 to obtain more information to better characterize the project areas. This additional data will be supplied to the various agencies involved in permit applications or other necessary actions.

The wildlife and vegetation surveys are being conducted by Beckee Beemer of The Dow Chemical Company, Sandy Dorken, terrestrial ecologist of the University of California, Davis, and Kent Fickett, ornithologist, of the University of California, Berkeley.

Transects have been established on the properties to describe riparian, ecotonal, and upland grass areas. Marshlands were studied separately.

The distribution and abundance of vegetation is dependent upon a variety of physical factors such as climate, soils, altitude, topography, exposure, and the seasonal availability of moisture. The various areas which share common physical features support natural groupings of plants. These groupings classified according to habitat are referred to as vegetation types. The vegetation type for each plant species is listed to aid the reader in matching the specific plant to the vegetation types map shown on Figure II-14 of the Draft EIR.

VEGETATION

Description of Montezuma Site

Vegetation. As described in the Environmental Setting of the Draft EIR, the Montezuma site consists of some 2,700 acres consisting largely of rolling hills covered with a variety of nonnative grasses, many of which were introduced by man. The area has been subject to intensive agricultural modification on a three-year rotational basis of cropping, grazing, and lying fallow. Construction of the proposed facilities will encompass some 600 acres of the site and a five-mile long corridor over which extensive modification (cut and fill) will occur to accommodate road and rail facilities.

Vegetation which grows on the site is highly varied in both type and abundance. There are a minimum of six vegetation types consisting of upland and lowland grasslands, river levee and swale areas, seasonal and permanent freshwater marsh, and the important Delta riparian areas fringing the Sacramento River. To date, 126 different species of forbs, grasses, bushes, trees, and other vegetation have been identified on the proposed site. A complete list of those species identified in the field and the vegetation type under which they are grouped is attached. Figure II-14 of the Draft EIR delineates the vegetation types which cover the McOmie property. Most of the area consists of upland grassland consisting largely of three species of barley and some brome and fiddleneck. Other dominant vegetation found growing in the other vegetation habitats are delineated after the floral species list for the Montezuma site.

The diversity of vegetative cover supports a wide variety of wildlife, particularly rodents which inhabit the grassland areas.

FLORA - McOMIE PROPERTY IN SOLANO COUNTY

Common Name	Scientific Name	Vegetation Type
Sea Purslane	Sesuvium verrucosum	1,4a
Blue Dicks	Brodiaea pulchella	1,2
Pepper Tree	Schinus molle	5
Indian Hemp	Apocynum cannabinium	5
Indian Milkweed	Asclepias eriocarpa	5
White Alder	Alnus rhombifolia	5
Fiddleneck	Amsinckia douglasiana	1,2
Fiddleneck	Amsinckia lycopsoides	1,2
Heliotrope	Heliotropium curvassicum var. oculatum	2,4a
Common catchfly	Silene gallica	1,2
Common chickweed	Stellaria media	1,2,3
Heartscale	Atriplex cordulata	2,4a
Australian salt brush	Atriplex semibaccata	4a
Nitrophilia	Nitrophilia occidentalis	4a,b
Parish's Glasswork/ Pickleweed	Salicornia subterminalis	4a,b
Russian thistle	Salsoa kali var. enuifolia	2,3
Western ragweed	Ambrosia psilostachya	2,3,5
Mayweed	Anthemis cotula	1,2
California aster	Aster chilensis var. medius	3
Mule fat	Baccharis viminea	2,3
Yellow star thistle	Centaurea solstitialis	2,3

KEY TO VEGETATION TYPE:

1 Upland grassland
2 Lowland grassland
3 River levees-swale
4 Freshwater marsh
  a Seasonal
  b Permanent
5 Delta riparian

Common Name	Scientific Name	Vegetation Type
Common or bull thistle	Cirsium vulgare	2,3
Franciscan thistle	Cirsium andrewsii*	4a
Chicory	Cichorium Intybus	3
Brass buttons	Cotula coronopifolia	4a
Cotton-batting/everlasting	Gnaphalium chilense	1,2
Great Valley grindelia	Grindelia camporum	1
Coastal isocoma	Haplopappus venetus ssp. vernoides	3,5
Sneezeweed/Rosilla	Helenium puberulum	3,5
California sunflower	Helianthus californicus	3,5
Sunflower	Helianthus gracilentus*	3
Telegraph weed	Heterotheca grandiflora	2
Smooth cat's-ear	Hypochoeris glabra	2,3
Prickly lettuce	Lactuca serriola	2,3,5
A sunflower	Lasthenia glabrata	2
Pineapple weed	Matricaria matricaroides	2,3
Bristly ox-tongue	Picris echoides	2,3
Common groundsel	Senecio vulgaris	1,2,3
California goldenrod	Solidago californica	2,3
Western goldenrod	Solidago occidentalis*	5
Milk thistle	Silybum marianum	2,3
Common sow thistle	Sonchus oleraceus	2
Common dandelion	Taraxacum officiale	1,2,3
Cocklebur	Xanthium strumarium var. canadense	2
Bindweed	Convolvulus arvensis	1,2
Hedgebind weed	Convolvulus sepium	3,5
Alkali weed	Cressa truxillensis var. vallicola	2,4a
Chinese/Indian mustard	Brassica juncea	3
Black mustard	Brassica nigra	2,3

KEY TO VEGETATION TYPE:

1 Upland grassland
2 Lowland grassland
3 River levees-swale
4 Freshwater marsh
  a Seasonal
  b Permanent
5 Delta riparian

*Plants seasonally common to the area but not identified during the study period.

Common Name	Scientific Name	Vegetation Type
Shepard's purse	Capsella bursa-pastoris	2
Prostrate hutchinsia	Hutchinsia procumbens	4a
Alkali peppergrass	Lepidium dictyotum	4a
Hoary cress	Lepidium draba var. repens	4
Shining peppergrass	Lepidium nitidum	1,2
Wild radish	Raphanus sativus	2,3
Wild cucumber	Marah fabaceus	1,2,3,5
A sedge	Carex barbarae	4a
Tule greatbulrush	Scirpus acutus	4b
California bulrush	Scirpus californicus	4b
Olneyi bulrush	Scirpus olneyi	4b
Common horsetail	Equisetum arvense	5
Braun's scouring-rush	Equisetum laevigatum	5
Elatine	Elatine rubella	4a,5
Turkey mullein	Eremocarpus setigerus	2,3
Alkali heath	Frankenia grandifolia	2
Centuary	Centaurium muehlenbergii*	5
Filaree	Erodium botrys	1,2
Filaree	Erodium cicutarium	1,2
Filaree	Erodium moschatum	1,2
Barb goatgrass	Aegilops triuncialis	2
Giant reed	Arundo donax	5
Slender wild oat	Avena barbata	1,2,3,5
False brome	Brachypodium distachyon	2,3,5
	Agropyron parishii	1
Pacific Bentgrass	Agrostis alba	2,3
Hairy brome	Bromus commutatus	2,3
Soft chess	Bromus mollus	1,2,3
Ripgut brome	Bromus diandrus	1,2,3,5
Red/Fostail brome	Bromus rubens	2,3

KEY TO VEGETATION TYPE:

1 Upland grassland
2 Lowland grassland
3 River levees-swale
4 Freshwater marsh
  a Seasonal
  b Permanent
5 Delta riparian

*Plants seasonally common to the area but not identified during the study period.

Common Name	Scientific Name	Vegetation Type
Bermuda grass	Cynodon dactylon	2
Salt grass (N)	Distichlis spicata nana	1,2,4a
Rattail fescue	Festuca myuros	1,2,3
Small fescue (N)	Festuca microstachys	2,3
Foxtail fescue	Festuca megalura	1,2,3
Foxtail barley (N)	Hordeum jubatum	2,3
Hare barley	Hordeum leporinum	1,2,3
Common barley	Hordeum vulgare	1,2
Italian ryegrass	Lolium muliflorum	1,2,3
Common reed	Phragmites communis	4a,5
Annual bluegrass	Poa annua	3
Great Valley phacelia	Phacelia ciliata	1,2
Black walnut	Juglans Hindsii	5
Baltic rush	Juncus balticus*	4a
Common/Bog rush	Juncus effusus var. pacificus	4a
Common horehound	Marrubium vulgare	3
Tule pea	Lathyrus jepsonii	4a,5
Birds-foot trefoil	Lotus corniculatus	3,5
Bur Clover	Medicago hispida	2,3
Spanish broom	Spartium junceum	2
Tomcat clover	Trifolium tridentatum	2
Common vetch	Vicia angustifolia	3
Asparagus	Asparagus officinalis	2
California loosestrife	Lythra californicum*	3,5
Cheeseweed	Malva parviflora	2,3,5
Eucalyptus (introduced planted)	Eucalyptus sp.	2
Oregon Ash	Fraxinus latifolia	5
Annual coast plantain	Plantago bigelovii	5
Mexican plantain	Plantago hirtella	5
English plantain	Platago lanceolata	2
Linanthus	Linanthus grandiflorus	2
Common knotweed	Polygonum aviculare var. littorale	5

KEY TO VEGETATION TYPE:

1 Upland grassland
2 Lowland grassland
3 River levees-swale
4 Freshwater marsh
  a Seasonal
  b Permanent
5 Delta riparian

*Plants seasonally common to the area but not identified during the study period.

Common Name	Scientific Name	Vegetation Type
Water smartweed	Polygonum punctatum	4a
Curly dock	Rumex crispus	2,3,5
Red maids	Calandria ciliata	1,2
Miner's lettuce	Montia perfoliata	2
Miner's lettuce	Montia spathulata	3
California Rose	Rosa californica	3
Pacific/California Blackberry	Rubus vitifolius	3,5
Buttonbush	Cephalanthus occidentalis var. californicus	5
Cottonwood	Populus fremontii	5
Goodding's willow	Salix Gooddingii	5
Valley willow	Salix hindsiana	5
Arroyo willow	Salix lasiolepia	5
Cat-tail-narrow leaved	Typha angustifolia	4b
Coyote thistle	Eryngium Vaseyi	5
Sweet fennel	Foeniculum vulgare	2,3,5
Marsh pennywort	Hydrocoytle verticillta var. triradiata	5
Small or swart nettle	Utrica urens	3

KEY TO VEGETATION TYPE:

1 Upland grassland
2 Lowland grassland
3 River levees-swale
4 Freshwater marsh
  a Seasonal
  b Permanent
5 Delta riparian

Summer Assessment. During the summer vegetation survey of the Montezuma site final identification of many species was accomplished with the addition of a few new species as can be seen in the following list:

ADDITIONAL SPECIES IDENTIFIED DURING SUMMER STUDY, 1975
McOMIE PROPERTY

Common Name	Scientific Name	Vegetation Type
Tarweed	Hemizonia fitchii	2
Gumweed	Grindelia camporum	2
Gnaphallum	Gnaphalium californicum	5
Blue Vernain	Verbena Hastata	5
Vernal grass	Anthoxanthum odoratum	2
Littleseed canary-grass	Phalaris minor	4,5
Bottlebrush squirrel-grass	Sitanion hystrix	2,3
White sweet clover	Meliotus alba	3,5
California Buttercup	Ranunculus californicus	2,3
Dwarf spearwort	Ranunculus pusillus	4

KEY TO VEGETATION TYPE:

1 Upland grassland
2 Lowland grassland
3 River levees-swale
4 Freshwater marsh
  a Seasonal
  b Permanent
5 Delta riparian

Prior to the summer survey some of the hilly upland grasslands had been plowed and left fallow. The vegetative regrowth was sparse in these areas. On the dry, lowland sandy areas most spring vegetation had completed life cycles and the many hardier composite species were dominant.

The Delta riparian area where moisture is available year round was still lush. Herbaceous wild flowers including monkeyflowers, sneezeweed, lupines, verbena, and gilia were abundant in the Sacramento River shoreline areas.

The preceding list includes the vegetation according to vegetation type. The number of species identified in each of the vegetation types is listed as follows:

Vegetation Type	Total Number of Species Identified
Upland grassland	29
Lowland grassland	71
River levees-swale	51
Freshwater marsh	
a) Seasonal	21
b) Permanent	9
Delta riparian	43

The lowland grassland which has not been subject to extensive agricultural management and has been the most disturbed (dredge spoil site) has the greatest number of floral species present.

Following in diversity are the river levees and swale areas, riparian areas, upland grassland, and finally the freshwater marsh. Seasonal marsh contains more species than the more stable permanent marsh.

Plant communities are characterized by the fact that they contain only a few species that are common. These are usually represented by large numbers of individuals or a large biomass. These few common species are called dominants. Other than the dominants there are usually a comparatively large number of species that are rare at any time or location, these are sometimes referred to as incidental species. A list of the dominant species found in each of the vegetative types or communities is listed below:

DOMINANT PLANT SPECIES ON McOMIE PROPERTY
SOLANO COUNTY, CALIFORNIA

Vegetation Cover Type	Dominant Plant Species	
	Common Name	Scientific Name
Upland Grassland	Common Barley	Hordeum vulgare
	Hare Barley	Hordeum leporinum
	Foxtail Barley	Hordeum jubatum
	Ripgut Brome	Bromus diandrus
	Fiddleneck	Amsinckia douglasiana
Lowland Grassland	Common Barley	Hordeum vulgare
	Hare Barley	Hordeum leporinum
	Bermuda Grass	Cynodon dactylon
	Ripgut Brome	Bromus diandrus
	Filaree	Erodium botrys
		Erodium cicutarium
		Erodium moschatum
	Fiddleneck	Amsinckia doublasiana
River Levees	Common Barley	Hordeum vulgare
	Hare Barley	Hordeum leporinum
	California Blackberry	Rubus vitifolius
	Ripgut Brome	Bromus diandrus
	Curly Dock	Rumex crispus
	Sandbar Willow	Salix hindsiana
Seasonal Marsh	Common Reed	Phragmites communis
	Saltgrass	Distichlis spicata nana
	Common Rush	Juncus effusus
	Pickleweed	Salicornia subterminalis
Permanent Marsh	Narrow-leaved Cattail	Typha angustifolia
	Common Bulrush	Scirpus acutus
	California Bulrush	Scirpus californicus
	Olneyi Bulrush	Scirpus olneyi
Delta Riparian	California Blackberry	Rubus vitifolius
	Sandbar Willow	Salix hindsiana
	Arroyo Willow	Salix lasiolepis
	Gooddings Willow	Salix gooddingii
	Ripgut Brome	Bromus diandrus
	Foxtail Barley	Hordeum jubatum
	Hare Barley	Hordeum leporinum

Mammals

Mammalian surveys of the Montezuma site indicate a diversity of mammals including different species of mice, rats, skunks, otter, weasels, rabbits, and opossum. A list of species follows:

MAMMALS OBSERVED OR SUSPECTED OF BEING PRESENT ON MCOMIE PROPERTY

Common Name	Scientific Name	Ecological Habitat
Common opossum	Didelphis marsupialis*	3
Ornate shrew	Sorex ornatus	3
California myotis bat	Myotis californicus	1,2,3
Black-tailed hare	Lepus californicus	3
Audubon cottontail	Sylvilagus audubonii	3
Beechey ground squirrel	Citellus beechyi	1
Botta pocket gopher	Thomomys bottae	1
Beaver	Castor canadensis*	3
Western harvest mouse	Reithrodontomys megalotis	1,3
Deer mouse	Peromyscus maniculatus*	1,3
Dusky-rooted wood rat	Neotmoa fuscipes*	1,2,3
California meadow mouse	Microtus californicus	1
Muskrat	Ondatra zibethica	3,4
Norway rat	Rattus norvegicus	3,4
House mouse	Mus musculus	1,2
Gray fox	Urocyon cinercoargenteus	1
Coyote	Canis latrans	1
Raccoon	Procyon lotor	3,4
Long-tailed weasel	Mustela frenata	3
Spotted skunk	Spilogale putorius*	1,3
Striped skunk	Mephitis mephitis	1,3
River otter	Lutra canadensis*	3,4
House cat	Felis domesticus	1

*possibly breeding on site

Key to Ecological Habitat most commonly found:

1. Grassland
2. Structures
3. Riparian-flatlands
4. Marsh

It should be noted that most mammals utilize a wide range of ecological habitats, but are most commonly found in the habitats listed above.

The grassland and riparian areas are the most heavily used by a majority of the species. However, structures (barns) also provide excellent shelter for some species during the entire year.

Agricultural grassland and marsh-riparian flatlands, the two major vegetation zones on the Montezuma site, are characterized by three mammalian habitats. Site usage by mammals was determined via transects of the McOmie Ranch which were made periodically (approximately 20 times) between February and July 1975. Conclusions on species diversity were reached through 1) actual siting, 2) scat evaluation, 3) burrow evaluation, 4) track evaluation, and 5) personal comments of owner and farmers of the property (i.e., coyote killings).

The grassland ecological habitat is characterized by rolling hills and flatland areas (approximately 200 feet elevation). The majority of the area is on a three-year rotational cropping, with occassional drainage valleys with scattered tule patches. The habitat is used by rodents, gophers, ground squirrels, skunks, raccoons, and coyotes for shelter feeding and other vital activities.

Old barns, wind mills, and their related structures (water tanks) are found throughout the property and represent a second major habitat. These structures provide shelter for most of the mammals on site at some time during the year (i.e., skunk and rodent nesting).

The last ecological habitat borders the Sacramento River and includes marsh and riparian areas. The marshes are primarily composed of tules (Typha) and rushes and willows; California blackberry, Oregon ash, and giant reeds grow along the River. Both areas provide protection for nesting and burrowing animals and food for almost all the mammals on the site.

All three habitats described play an equal role as they pertain to mammalian use. All areas may be used by the same mammal during his daily range of foraging. (i.e.) The racoons live in the barns or riparian for shelter yet may forage in the grassland and riparian.

Birds

The Montezuma site provides a large productive area for resident and overwintering birdlife. The agricultural and nonagricultural areas provide sufficient food for the passerine and other migrating species. The rodent populations that are found in the area year-round provide a food source for the overwintering hawks, falcons, and other raptors. As spring approaches and the migrating birds continue their way north and eastward, the populations of birds noticeably decrease. There is also an increase in bird populations in the marsh-riparian areas along the Sacramento River. These river-associated habitats support a high density and diversity of breeding species not always present in the winter.

During the summer months the number of birds and utilization of the grassland and riparian zones becomes extremely limited. The lack of water inland contributes to the reduction of bird diversity and density in comparison to winter and spring months.

In the winter of 1974, spring and summer of 1975, extensive field studies were conducted by Kent Fickett, an ornithologist with the University of California at Berkeley. These quantitative studies were to help determine the resident bird species and, if possible, the migrant bird populations. The studies also considered the possible range of any rare or endangered species in the area. The black rail was not found or heard but is known to inhabit the area and is probably a member of the population along the riparian zone. The burrowing owl is found on the site, and at least five breeding pairs were observed which would probably indicate year-round habitation. The site provides an essential nesting area for the burrowing owl population.

The brackish marshes are presently inhabited by the Suisun Song Sparrow, a species whose status is presently unknown. The Prairie Falcon, another threatened species was sited foraging in the grasslands. A discussion of other species considered rare or endangered whose distribution encompasses the two proposed sites is contained in a subsequent section of this chapter.

In the two major vegetation zones, the agricultural grassland and the marsh-riparian zones, three basic ecological habitats for birds, are represented. The leached drainage valleys with seasonal slow moving water provide foraging area for hawks, shorebirds, and waterfowl during the winter months and nesting

and feeding areas for kildeer, ducks, and blackbirds during the spring. In the summer the area is dry and is utilized for foraging by raptors.

The rolling hills which are under three-year rotational agriculture, represent the majority of the Montezuma site. There is heavy use during the winter months by foraging hawks and owls. Insect and seed-eating birds such as sparrows, pheasants, and meadow larks utilize the area for feeding during winter months and nesting during the spring. Very little use is made of these areas during the summer except for limited foraging by predator species such as the red-tailed hawk and American Kestrel.

The marsh and riparian areas are characterized by willows and California blackberry thickets along the River with tules and willows surrounding the seasonal marshes. The marshes represent a limited resource which at this time may support unique birdlife that cannot live elsewhere. Year-round usage exists for many species. The riparian provides essential cover, nesting, and feeding areas for many species of sparrows, warblers, swallows, rails, and a variety of others. A more complete list of birds observed is attached.

These studies are, of course, limited and cannot indicate the populations of birds that would be found year-round or from year to year. However, studies are being continued into the fall months of 1975 to give a better indication of the bird life in the area. The species lists were compiled from extensive on site visits only, which were made between February 21 and August 22, 1975.

LIST OF BIRD SPECIES OBSERVED ON THE MCOMIE RANCH

WINTER AND SUMMER ASSESSMENTS

Common Name	Scientific Name	Winter*	Summer*
Cinnamon teal	Anas cyanoptera	40	
Green-winged teal	Anas carolinenas	10	
Turkey vulture	Cathartes aura	2	1
White-tailed kite	Elanus leucurus	14	
Marsh hawk	Circus cyaneus	30	1
Rough-legged hawk	Buteo lagopus	1	
Red-tailed hawk	Buteo jamaicensis	25	3
Prairie falcon**	Falco mexicanus	1	
American kestrel	Falco sparverius	30	4
California quail	Lophortyx californicus	unknown	
Ring-necked pheasant	Phasianus colchicus	800	3
American bittern	Botaurus lentiginosus		
American coot	Fulica americana	30	
Killdeer	Charadrius vociferus	8	
Herring gull	Larus argentatus	5	
California gull	Larus californicus	10	
Mourning dove	Zenaidura macroura	20	30
Burrowing owl**	Speotyto cunicularia	8	6
Anna's hummingbird	Calypte anna	1	
Red-shafted flicker	Colaptes cafer	2	
Downy woodpecker	Dendrocopus pubescens	1	
Violet-green swallow	Tachycineta thalassina	2	
Common bushtit	Psaltriparus minimus	40	
Water pipit	Anthus spinoletta	5,000	
Loggerheaded shrike	Lanius ludovicianus	20	8
Yellow-rumped warbler	Dendroica coronata, audubon	40	1
House sparrow	Passer domesticus	80	
Starling	Sturnus vulgaris	20	
Western meadowlark	Sturnella neglicta	3,000	7
Red-winged blackbird	Agelaius phoeniceus	2,000	
Brewer's blackbird	Euphagus cyanocephalus	1,000	80
House finch	Carpodacus mexicanus	300	
American goldfinch	Spinus tristis	60	
Rufous-sided towhee	Pipilo erythrophthalmus	100	

*Approximate numbers.
**Indicates rare, endangered, or of extreme interest.

Common Name	Scientific Name	Winter*	Summer*
Brown towhee	Pipilo fuscus	25	
Savannah sparrow	Passerculus sandwichensis	200	
White-crowned sparrow	Zonotrichia leucophrys	850	
Golden-crowned sparrow	Zonotrichia atricopilla	700	
Song sparrow	Melospiza melodia	20	15
Suisun song sparrow**	Melospiza melodia maxillaris	200	
Rough-winged swallow	Stelgidopteryx ruficollis		20

*Approximate numbers
**Indicates rare, endangered, or of extreme interest.

DESCRIPTION OF PITTSBURG SITE

Vegetation

The presently undeveloped partially modified Pittsburg site, covers approximately 200 acres. The majority of the land is agricultural grassland, having been planted to barley in the past. It is now left fallow and disced to eliminate fire hazards.

The site is in an industrial zone bordered on three sides by industry. The City of Pittsburg wastewater treatment facilities (Camp Stoneman), U. S. Steel, and the existing Dow Pittsburg plant are the closest properties. To the east, the property is dry farmed. The closest residential development is one-half mile to the south.

The Pittsburg property is characterized by Lower Sonoran Life Zone vegetation. It consists of two vegetation types, lowland grassland and, prior to August 1975, a small freshwater marsh-riparian area along Kirker Creek.

The grassland has historically been planted with barley and can be considered a disturbed site. There are few native plants in this area because most species have been replaced by man (European herbaceous annuals).

A few native grasses (small fescue, foxtail, and barley) are found in this area but are common over most of California. A species list of all plants observed or collected on site during winter, spring, and summer assessments is listed below. Included are the results of the latest summer vegetation assessment which are listed separately since this list did not appear in the Draft EIR. The entire list reflects corrections and positive identification of plant species made during previous surveys.

FLORA IDENTIFIED ON THE PITTSBURG PROPERTY IN CONTRA COSTA COUNTY

Common Name	Scientific Name	Vegetation Type
Sea purslane	Sesuvium verrucosum	2,4
Blue dicks	Brodiaea pulchella	4
Milkweed	Ascelepias vestita	5
Fiddleneck	Amsinckia douglasiana	2,5
Fiddleneck	Amsinckia lycopsoides	2,5
Heliotrope	Heliotropium curvassium var. oculatum	2
Common chickweed	Stellaria media	2
Parish's Glasswort/ Pickleweed	Salicornia subterminalis	4
Pickleweed	Salicornia virginica	4
Russian thistle	Salsoa hali var. tenufolia	5
Western ragweed	Ambrosia psilostachya	5
Mayweed	Anthemis cotula	2,5
Yellow star thistle	Centurea solstitialis	2,5
Common thistle	Cirsium vulgare	5
Cotton-batting	Gnaphalium chilense	2,5
Prickly lettuce	Lactuca serricola	2,5
Pineapple weed	Matricaria matricaroides	2
Sunflower	Monolopia major	5
Bristly ox-tongue	Picrus echoides	2,5
Common groundsel	Senecio vulgaris	2,5
Milk thistle	Silybum marianum	2,5
Cocklebur	Xanthium strumarium var. canadense	5
Bindweed	Convulvulus arvensis	2
Hedgebind weed	Convolvulus sepium	2,5
Mustard	Barbera vulgaris	2,5
Chinese/Indian mustard	Brassica juncea	2,5
Black mustard	Brassica nigra	2,5
Charlock	Brassica Kaber	2,5
Shepard's purse	Capsella bursa-pastoris	2
Prostate hutchinsia	Hutchinsia procumbens	5

Key to Vegetation Type:

1. Upland grassland
2. Lowland grassland
3. River levees-swale
4. Freshwater marsh
   a. seasonal
   b. permanent
5. Delta riparian

Common Name	Scientific Name	Vegetation Type
Wild radish	Raphanus sativus	2,5
Wild cucumber	Marah fabaceus	2,5
Sedge	Corex barbareae	4
Tule	Scirpus acutus	4
California bulrush	Scirpus californicus	4
Olneyi bulrush	Scirpus olneyi	4
Turkey mullein	Eremocarpus setigerus	2
Alkali heath	Frankenia grandifolia	2
Filaree	Erodium botrys	2,5
Filaree	Erodium cicutarium	2,5
Filaree	Erodium moschatum	2,5
Wild geranium	Geranium dissectum	2,5
Wild oats	Avena sativa	2,5
False brome	Brachypodium distachyon	2
Hairy brome	Bromus commutatus	2,5
Soft chess	Bromus mollis	2,5
Ripgut brome	Bromus diandrus	2,5
Red/Foxtail brome	Bromus rubens	2,4
Bermuda grass	Cynodon dactylon	2
Salt grass	Distichlis spicata nana	4
Brome fescue	Festuca bromoides	2
Rattail fescue	Festuca myuros	2,5
Small fescue	Festuca microstachys	2
Foxtail fescue	Festuca megalura	2,5
Foxtail barley	Hordeum jubatum	2
Hare barley	Hordeum leporinum	2,5
Common barley	Hordeum vulgare	2
Italian ryegrass	Lolium muliflorum	1,3
Common reed	Phragmites communis	4
Annual bluegrass	Poa annua	2
California buckeye	Aesculus californica	5
Great Valley phacelia	Phacelia ciliata	2
Black walnut	Juglans Hindsii	5
Baltic rush	Juncus balticus	4

Key to Vegetation Type:

1. Upland grassland
2. Lowland grassland
3. River levees-swale
4. Freshwater marsh
   a. seasonal
   b. permanent
5. Delta riparian

Common Name	Scientific Name	Vegetation Type
Common/Bog rush	Juncus effusus var. pacificus	4
Common horehound	Marrubium vulgare	2
Birds-foot trefoil	Lotus corniculatus	2
Lupine	Lupinus bicolor	2
Bur clover	Medicago hispida	2
White clover	Trifolium repens	2
Tomcat clover	Trifolium tridentatum	2
Cheeseweed	Malva parviflora	2,5
Common knotweed	Polygonum aviculare var. littorale	2
Curly dock	Rumex crispus	2,5
Red maids	Calandria ciliata	2
Miners lettuce	Montia perfoliata	2
Miners lettuce	Montia spathulata	2
Cottonwood	Populus fremontii	5
Goodding's willow	Salix Gooddingii	5
Valley willow	Salix hindsiana	5
Arroyo willow	Salix lasiolepia	5
Owl's clover	Orthocarpus purpurascens	2
Cattail-narrow leaved	Typha angustifolia	4
Coyote thistle	Eryngium Vaseyi	5
Sweet fennel	Foeniculum vulgare	2,5
Small or swart nettle	Utrica urens	5

Key to Vegetation Type:

1. Upland grassland
2. Lowland grassland
3. River levees-swale
4. Freshwater marsh
   a. seasonal
   b. permanent
5. Delta riparian

SUMMER ASSESSMENT
(PITTSBURG)

Common Name	Scientific Name	Vegetation Type
Sneezeweed	Helenium puberulum	2,3,5
Tarweed	Hemizonia fitchii	2
Gumweed	Grindelia camporum	2
Alkali peppergrass	Lepidium draba var. repens	4
Gnaphalium	Gnaphalium californicum	5
Blue vernain	Verbena hastata	5
Watergrass	Echinocolo crusgalli	4,5
Littleseed canarygrass	Phalaris minor	4,5
Rabbitsfoot grass	Polypogon monspeliensis	4,5
Bottlebrush squirrel grass	Sitanion hystrix	2,3
Common Vetch	Vicia angustifolia	3
Mexican Plantain	Plantago hirtella	5
English Plantain	Plantago lanceolata	2
California buttercup	Ranunculus californicus	2,3

Mammals

Attached is a list of mammalian species using, or possibly using, the Pittsburg site. It should be noted that while noticeably smaller in size and closer to industry, the Pittsburg site is nearly equivalent in diversity to the Montezuma property.

Visits to the Pittsburg site were made four times between February and April 1975. Conclusions on site usage by mammals were reached by: 1) observation, 2) scat evaluation, 3) track evaluation, 4) burrow evaluation, and 5) personal comments from workers in the local area.

The three ecological mammalian habitats resemble those previously described on the Montezuma site. The grassland area has a past history of agricultural use and is not utilized by mammals as a burrowing and feeding area.

The structures are few in number and consist of a train trestle and old homestead site. These provide some shelter and a few burrow sites.

The marsh and riparian areas around Kirker Creek were most heavily used by the mammals for burrows, nesting sites, and food sources.

MAMMALS OBSERVED OR SUSPECTED OF
BEING PRESENT ON LOS MEDANOS PROPERTY

Common Name	Scientific Name	Ecological Habitat
Common opossum	Didelphis marsupialis*	3
Ornate shrew	Sorex ornatus	3
California myotis bat	Myotis californicus	1,2,3
Black-tailed hare	Lepus californicus	3
Audubon cottontail	Sylvilagus audubonii	3
Beechey ground squirrel	Citellus beechyi	1
Botta pocket gopher	Thomomys bottae	1
Beaver	Castor canadensis*	3

KEY TO ECOLOGICAL HABITAT MOST COMMONLY FOUND

1 Grassland
2 Structures
3 Riparian-flatlands
4 Marsh

*Possibly breeding on site.

Common Name	Scientific Name	Ecological Habitat
Western harvest mouse	Reithrodontomys megalotis	1,3
Deer mouse	Peromyscus maniculatus*	1,3
Dusky-footed wood rat	Neotoma fuscipes*	1,2,3
California meadow mouse	Microtus californicus	1
Muskrat	Ondatra zibethica	3,4
Norway rat	Rattus norvegicus	3,4
House mouse	Mus musculus	1,2
Gray fox	Urocyon cinercoargenteus	1
Coyote	Canis latrans	1
Raccoon	Procyon lotor	3,4
Long-tailed weasel	Mustela frenata	3
Spotted skunk	Spilogale putorius*	1,3
Striped skunk	Mephitis mephitis	1,3
River otter	Lutra canadensis*	3,4
House cat	Felis domesticus	1

KEY TO ECOLOGICAL HABITAT MOST COMMONLY FOUND
1 Grassland
2 Structures
3 Riparian-flatlands
4 Marsh

*Possibly breeding on site.

Birds

A list of birds observed at the Los Medanos property (Pittsburg site) and their approximate numbers during the spring and summer surveys is shown below:

Common Name	Scientific Name	Approx. #s Spring	Summer
Mallard duck	Anas platyrhynchos*	2	
Cinnamon teal	Anas cyanoptera*	8	
Ring-necked duck	Aythya collaris	2	
Turkey vulture	Cathartes aura	2	
White-tailed kite	Elanus leucurus*	2	
Marsh hawk	Circus cyaneus*	3	1
Red-tailed hawk	Buteo jamaicensis*	1	
American kestrel	Falco sparverius*	1	3
Ring-necked pheasant	Phasianus colchicus*	4	
Snowy egret	Leucophoyx thula	1	
American bittern	Botaurus lentiginosus*	5	
Sora rail	Porzana carolina*	1	
American coot	Fulica americana*	20	
Killdeer	Charadrius vociferus*	1	1
Ring billed gull	Larus delawarensis	2	
Mourning dove	Zenaidura macroura*	8	
Common flicker	Colaptes cafer*	2	
Barn swallow	Hirundo rustica	15	
Cliff swallow	Petrochelidon pyrrhonota	5	
Violet green swallow	Tachycineta thalassina	20	
Tree swallow	Iridoprocne bicolor*	2	
Common crow	Corvus cryptoleucus	4	
Long-billed marsh wren	Telmatodytes palustris*	15	
Mockinbird	Mimus polyglottos*	8	
Golden crowned kinglet	Regulus satrapa	2	
Water pipit	Anthus spinoletta	60	
Loggerhead shrike	Lanius ludovicianus*	1	
Orange crown warbler	Vermivora celata*	2	
Yellow-rumped warbler	Dendroica coronata, audubon*	200	
Yellow throat warbler	Dendroica dominica*	25	
Western meadow lark	Sturnella neglicta*	20	

*Possibly breeding on site

Common Name	Scientific Name	Approx. #s Spring	Summer
Red-winged blackbird	Agelaius phoeniceus*	6	
Brewer blackbird	Euphagus cyanocephalus*	4	2
American goldfinch	Spinus tristis*	8	
Savannah sparrow	Passerculus sandwichensis	35	
Dark eyed junco	Junco oreganus	10	
White crowned sparrow	Zonotrichia leucophrys*	80	
Golden crowned sparrow	Zonotrichia atricopilla	10	
Lincoln sparrow	Melospiza lincolnii*	1	
Song sparrow	Melospiza melodia*	100	4
Rufous-sided towhee	Pipilo erythrophthalmus*	4	

*Possibly breeding on site.

The birds observed at the site in the spring were much more numerous than in the summer. This is expected due to the migratory nature of many species. Most numerous were seed-eating sparrows, insectivorous warblers, and water pipits. Meadowlarks, blackbirds, and other birds frequently found in open fields were observed. Raptors included the American kestrel (sparrow hawk) and marsh hawk which are probably permanent residents as well as the white-tailed kite and red-tailed hawk. Waterfowl and marsh birds were not abundant, but a diversity was observed including waterfowl, shorebirds, and marshbirds. Game birds included the Ring-necked pheasant and Mourning dove, Cinnamon teal, and two other ducks.

DESCRIPTION OF LOWER SHERMAN ISLAND

Vegetation

A brief vegetation survey of Sherman Island was done on August 5, 1975, to obtain a more detailed species list. Fringe areas of the Island and interior marshes and bogs were visited and vegetation collected.

The perimeter of the Island is composed of Delta Riparian vegetation types. The dominant plants in this strip are Blackberries (Rubus), willows (Salix), and sedges (Scirpus). Rushes and sedges form the outermost band of vegetation on the wet, sandy beaches. On the drier levees, California Blackberry forms a thick wall, leading into stands of willow with scattered patches of Cottonwood (Populus).

The riparian habitats lead into open, sandy marsh and bog areas. The open marshes have the greatest species diversity and host plantains, pickleweed, giant reed, and salt grass.

The bog area, which comprises most of the island interior, is very moist. In some areas, the vegetation opens up into potholes or small lakes which attract waterfowl in the winter migrating season. Within the bogs, species dominance fluctuates between sedges, bulrushes, and cattails. The vegetation in the interior is extremely dense. All the vegetation in this area is adapted to inundation by water; Scirpus seemed to be the dominant genus in the bogs.

An air survey was conducted August 12, 1975, to establish vegetation patterns and to locate possible major habitat changes in inner portions of the Island. The vegetation is extremely dense but is consistent with the 1972 transect findings and the recent survey completed in August 1975. No obvious dry oasis is apparent which would provide additional sensitive habitat to those described in the Island perimeter.

A survey was also made to reexamine the right-of-way for the existing Dow pipeline which was completed in 1973. Plants of the bog and marsh areas on Lower Sherman Island are hardy and have adapted to the disturbance, as years ago, they would have reestablished after heavy flooding. The construction site was barely detectable.

The Delta riparian area is the most sensitive vegetation type on the Island. Pipeline construction might disturb a portion of this habitat. Construction will disturb vegetation and wildlife but regrowth should occur in several years as demonstrated by the previous pipeline construction.

A list of known flora and fauna found on Sherman Island is listed below:

SUMMER FLORAL SURVEY FINDINGS

VEGETATION

Common Name	Scientific Name	Vegetation Type
Sedge	Cyperus sp.	
Cattail	Typha sp.	
Cottonwood	Populus sp.	
Eucalyptus	Eucalyptus sp.	
Willow	Salix sp.	
Blackberry	Rubus sp.	
Sea Purslane	Sesuvium verrucosum	4
Pickleweed	Salicornia subterminalis	4
Russian Thistle	Salsoa kali	1,2
Western Ragweed	Abrosia psilostachya	1,2
Mule Fat	Baccharis chilensis var. medius	1,2
Yellow Star Thistle	Centaurea solstitialis	1,2
Brass Buttons	Cotula coronopifolia	4
Sneezeweed	Helenium puberulum	1
Prickly lettuce	Lactuca serriola	1,2
Pineapple Weed	Matricaria matri caroides	2
Common Groundsel	Senecio vulgaris	2
California Goldenrod	Solidago california	2
Common Sow Thistle	Silybum marianum	2
Gnaphalium	Gnaphalium californicum	1
Blindweed	Convolvulus arvensis	2
Hedgebindweed	Convolvulus sepium	1
Alkali Weed	Cressa truxillensis var. vallicola	4
Black Mustard	Brassica nigra	1
Wild Radish	Raphanus satiua	1
Tule Bulrush	Scirpus acutus	3,4
California Bulrush	Scirpus californicus	3,4
Olney Bulrush	Scirpus olneyi	3,4
Baltic Rush	Scirpus balticus	3,4
Common Horsetail	Equisetum arvense	4
Giant Reed	Arundo dumax	4
Turkey Mullein	Enemocarpus setigerus	1
Slender Wild Oat	Avena barbata	1
Ripgut Brome	Bromus diandrus	1,2
Bermuda Grass	Ayhodon dactylon	1
Blue Wild Rye	Elymus triticoides	1
Vernal Grass	Anthoxanthum odoratum	1,2

Common Name	Scientific Name	Vegetation Type
Water Grass	Echinocola crusgalli	1
Salt Grass	Distichlis spicata nana	4
Foxtail Fescue	Festuca megalura	1,4
Foxtail Barley	Hordeum jubatum	1,2
Italian Ryegrass	Lolium multiflorum	2
Timothy Grass	Pheleum pratense	2,4
Little seed Canarygrass	Phalaris minor	2
Bottlebrush Squirrel	Sitanion hystrix	1
Lotus	Lotus junceus	1
Bur Clover	Medicago hispida	1
White Sweet Clover	Melilotus alba	1

MAMMALS

Mink	Mustela vision
Muskrat	Ondatra zibenthica
Opossum	Didelphis marsupialis
Cottontail Rabbit	Sylvilagus auduboni
Raccoon	Procyon lotor
Striped Skunk	Mephitis mephitis
River Otter	Lutra canadensis
Beaver	Castor canadensis

Birds likely to be found on Sherman Island are similar to those found at either of the riparian or marsh areas of the mainland sites. (See previous lists.)

Species Likely to be Found in the Study Area or Its Environs

Other animal species are likely to be found in the areas encompassed by the proposed project. Although not observed during the field surveys, there are a number of reptiles, amphibians, birds, and a variety of aquatic organisms which may be impacted by the proposed project. The following lists compiled from a variety of published sources summarize most of the important vertebrate species (and some aquatic invertebrates) which may inhabit the area. Not included are insects, worms, and other invertebrates.

REPTILES AND AMPHIBIANS WHICH HAVE BEEN OBSERVED, ARE LIKELY TO BE OBSERVED, OR PROBABLY INHABIT PORTIONS OF THE PROPOSED SITES

Common Name	Scientific Name	Habitat Type
Reptiles		
Western fence lizard	Sceloporus occidentalis	1,2,5
Pacific gopher snake	Pituophis melanoleucus catenifer	1,2,3
Western pond turtle	Clemmys marmorata	4b
Western skink	Eumeces skiltonianus	2,5
California alligator lizard	Gerrhonotus multicarinatus	1,2,5
Common garter snake	Thamnophis sirtalis ssp.	2,3,4a,4b,5
California kingsnake	Lampropeltis getulus californiae	all types
Western yellow-bellied racer	Coluber constricter mormon	1,2,3
Sharp-tailed snake	Contia tenuis	2,3,5
Coast garter snake	Thamnophis elegans terrestris	2,3,4a,4b
Pacific rubber boa	Charina bottae bottae	2,3,4a,4b,5
Amphibians		
California toad	Bufo boreas halophilus	2,3,4a,4b,5
Pacific treefrog	Hyla regilla	2,4a,4b,5
California red-legged frog	Rana aurora draytoni	4a,4b
Bullfrog	Rana catesbeiana	4b
California newt	Taricha torosa	4a,4b,5
Arboreal salamander	Aneides lugubris	5
California slender salamander	Batrachoseps attenuatus	3,5

HABITAT TYPE
1 Upland grassland
2 Lowland grassland
3 River levee-swale
4 Freshwater marsh
a Seasonal
b Permanent
5 Delta Riparian

Avian fauna observations in the area over a previous two-year study period (Jones & Stokes, 1974) as well as the surveys done in the preparation of the Draft EIR have shown that the number of bird species varies in both number and abundance seasonally. The greatest numbers occur during late winter and early spring

which reflect the occurrence of migratory waterfowl, songbirds, and raptors. During the summer months (June through August) the number of birds observed is much lower since only permanent or summer resident species are likely to be found in the area.

Those species which are known to frequent the area, but are not listed as being observed at the proposed sites, are included in order to provide some indication of the wide variety of birds found in the Suisun Marsh area. This list supplied by the California Department of Fish and Game contains some 91 additional species not observed at the Montezuma site.

OTHER BIRD SPECIES LIKELY TO BE OBSERVED
FROM THE PROPOSED SITES OR THEIR ENVIRONS
(not actually observed)

Common Name	Scientific Name
GENERAL AVIAN FAUNA	
Mockingbird	Mimus polyglottos
Bandtail pidgeon	Columba fasciata
Yellowthroat	Geothlypis trichas
Short-eared owl	Asio flammeus
White-throated swift	Aeronautes saxatalis
Roadrunner	Geococcyx californianus
Belted kingfisher	Megaceryle alcyon
Black phoebe	Sayornis nigricans
Scrub jay	Aphelocoma coerulescens
Yellow-billed magpie	Pica nuttalli
California thrasher	Toxostoma redivivum
House finch	Carpodacus mexicanus
Rufous-sided towhee	Pipilo erythropthalmus
Allen's hummingbird	Selasphorus sasin
Cliff swallow	Petrochelidon pyrrhonota
Brown-headed cowbird	Molothrus ater
Great-horned owl	Bubo virginianus
Cooper's hawk	Accipiter cooperi
Sharp-shinned hawk	Accipiter striatus
Ferruginous hawk**	Buteo regalis
American peregrine falcon*	Falco peregrinus

*Rare, endangered, or threatened species
**Status undertermined

Source: "List of Birds Observed" by California Department of Fish and Game personnel in Suisun Marsh and its immediate environs.

Common Name	Scientific Name
Say's phoebe	Saynoris saya
Tree swallow	Iridoprocne bicolor
Southern bald eagle*	Haliaeetus leucocephalus
Hermit thrush	Hylocichla guttata
Ruby-crowned kinglet	Regulus calendula
Cedar waxwing	Bombycilla cedorum
Northern shrike	Lanius excubitor
Audubon's warbler	Dendroica auduboni
Tricolored blackbird	Agelaius tricolor
Common nighthawk	Chlordeiles minor
SHOREBIRDS, WADING BIRDS, AND OTHER MARSHBIRDS	
Pectoral sandpiper	Erolia melanotos
Long-billed curlew	Numerius americanus
Western willet	Catoptrophorus semipalmatus
Whimbrel	Numerius phaeopus
Clapper rail	Rallus longirostris
California black rail	Laterallus jaimaicensis coturniculus
Snowey egret	Leucophoyx thula
Green heron	Butorides vierscens
Sandhill crane	Grus canadensis
Semipalmated plover	Charadrius semipalmatus
Black-bellied plover	Squatarola squatorola
American avocet	Recurvirostra americana
Sanderling	Crocethia alba
Snowy plover	Charadrius alexandrinus
Marbled godwit	Limnosa fedoa
Black-crowned night heron	Nyctacorar myctacorax
Greater egret	Casmerodius albue
Red knot	Caladris canutus
Dunlin	Erolia alpina
Western sandpiper	Ereuneter mauri
Ruddy turnstone	Arenaria interpres
Common egret	Casmerodius albus
Common gallinule	Gallinula chloropus
Long-billed dowitcher	Limnodromus scolopaceus
Common snipe	Capella gallinago

*Rare or endangered species

Common Name	Scientific Name
SEABIRDS AND OTHERS	
Glaucus-winged gull	Larus glaucescens
Western Gull	Larus occidentalis
Caspian Tern	Hydroprogne caspio
Elegant Tern	Thalasseus elegans
Black Tern	Chlidonias niger
Royal Tern	Thalasseus maximus
Horned Grebe	Podiceps auritus
Eared Grebe	Podiceps caspicus
Western Grebe	Aechmophorus occidentalis
Pied-billed Grebe	Podilymbus podiceps
Bonaparte's Gull	Larus philadelphia
Double-crested Cormorant	Phalocrocorax auritus
Ring-billed Gull	Larus clelewarensis
White Pelican	Pelecanus erythrorhynchos
Canvasback	Aythya valisineria
American Widgeon	Mareca americana
Red-breasted Merganser	Mergus serrator
Greater Scaup	Aythya affinis
Lesser Scaup	Aythya marila
Ruddy Duck	Oxyura jamaicensis rubida
Surf Scoter	Melanitta perspicillata
Arctic loon	Gavia arctica

Aquatic Species

A number of important aquatic organisms are found in the estuarine waters of the Sacramento-San Joaquin Delta. These have been discussed in some detail in the Draft EIR. Construction of the proposed facilities, the pipelines connecting the two sites, and particularly the docking facilities will affect aquatic life.

Important aquatic species known to occur in the waters adjacent to the two proposed sites and their environs (Sherman Island and Suisun Marsh) are listed below:

Common Name	Scientific Name
ZOOPLANKTON	
Opossum shrimp	Neomysis awatschensis
Calanoid copepod	Acartia clausi
Calanoid copepod	Diaptomus spp.
Calanoid copepod	Eurytemora affinis
Cyclopoid copepod	Cyclops spp.
Harpacticoid copepod	Euterpina spp.
ZOOBENTHOS	
Amphipod	Corophium spinicorna
Amphipod	Corophium stimpsoni
Colonial hydroid	Hydrozoa sp.
Asiatic Clam	Corbicula fluminea
FISH	
Freshwater	
Carp	Cyprinus carpio
Goldfish	Carassius auratus
Sacramento Blackfish	Orthodon microlepidotus
Sacramento Squawfish	Ptychocheilus grandis
Splittail	Pogonichthys macrolepidotus
White Catfish	Ictalurus catus
Black Crappie	Pomoxis nigromaculatas
Bluegill	Lepomis macrochirus
Tule Perch	Hysterocarpus traski
Prickly Sculpin	Cottus asper
Western Sucker	Catostomus occidentalis
Brown Bullhead	Ictalurus nebulosus
Hitch	Lavinia exilicauda
Hardhead	Mylopharodon concocephalus
Sacramento Western roach	Hesperoleucus symmetricus symmetricus
Pacific speckled dace	Rhinichthys osculus carringtonii
Golden shiner	Notemigonus crysoleucas
Anadromous	
Pacific Lamprey	Entosphenus tridentatus
White Sturgeon	Acipenser transmontanus
Green Sturgeon	Acipenser medirostris
American Shad	Alosa sapidissima
King Salmon	Oncorhynchus tshawytsha
Steelhead Trout	Salmo gairdneri
Striped Bass	Roccus saxatilis

Common Name	Scientific Name
Euryhaline	
Threadfin Shad	Dorosoma petenense
Delta Smelt	Hypomesus transpacificus
Threespine Stickleback	Gasterosteus aculeatus
Sacramento Smelt	Spirinchus thaleichthys

This list was compiled utilizing a number of sources which are referenced at the end of this chapter.

Among the species listed are 6 species of zooplankton, 4 species of zoobenthos, and 28 species of fishes.

Additional information on zoobenthos is included in this section in response to a request for data on the biomass of zoobenthic organisms adjoining the proposed sites.

Zoobenthos

Biomass in waters adjacent to the two proposed sites is low as shown by studies completed by the California Department of Fish and Game (Kelley, 1966). Average monthly biomass of the zoobenthos, fish, and wildlife food organisms found during sampling of transects in the Delta near the proposed sites showed less than 0.2 cubic centimeters per square foot (cc/ft^2). This value is low compared to a biomass of 1-4.5 cc/ft^2 in the Carquinez Strait and San Pablo Bay.

Zoobenthic organisms serve as important food for a variety of fishes and diving birds. The species found in waters adjoining the proposed project site areas are listed above.

RARE AND ENDANGERED SPECIES

A more complete discussion of those species whose distribution encompasses the study area which are considered endangered, rare, or threatened species is contained in the following section. An endangered species is a plant or animal which is threatened by environmental changes, habitat destruction, or reproductive failure such that its continued existence is questionable. Rare species are those whose range is restricted to a small or specialized habitat and is incapable of adapting to different environmental conditions.

On-site assessments were made with transects of the McOmie Ranch periodically between February and July 1975. During this time, the ornithological and mammalian species lists were compiled. In addition, the California Department of Fish and Game has published lists for rare and endangered species and for species being considered for the rare and endangered list which are given an undetermined status.

On these two Department of Fish and Game lists are nine species which have a known distribution which encompasses the two project sites. Of these nine, three were observed using the project site in some manner. The Prairie Falcon (Falco mexicanus) is listed as a threatened species, the Suisun Song Sparrow (Melospiza melodia maxillaris), and the Burrowing Owl (Speotyto cunicularia) both were given undetermined status.

The Prairie Falcon was sited in the grassland area on the Montezuma site which is utilized as a feeding ground. No nesting sites nor any areas noted as being suitable nesting habitat were discovered. The area provides feeding territory for this migratory species. Adjoining parcels not utilized by the project could provide food sources primarily for rodents.

The Suisun Song Sparrow has been observed in the riparian marsh zone. This conclusion was reached from on-site observations and study of previously collected remains at the Museum of Vertebrate Zoology at U.C. Berkeley. The proposed project will not directly affect the Song Sparrow habitat as no significant construction will take place in the riparian marsh zone. The wildlife enhancement program to be undertaken will ultimately provide additional habitat.

At least five breeding pairs of Burrowing Owls were found on site which indicates probable year-round habitation. The site provides an essential nesting area for the Burrowing Owl population. Many of the colonies are located along roadways and near structures which indicates species tolerance to low-key, man-related activities. Two colonies would be directly influenced by the proposed plant site. Before construction takes place, an attempt will be made to capture and relocate the impacted Burrowing Owl in the two effected areas. The other colonies are isolated from the impacted area.

The Alameda Striped Racer, a snake, has been found only on grassy slopes in Contra Costa County. A few specimens may exist in the general area of the Pittsburg site, but no evidence or observations have been made to confirm the presence at the proposed project site.

The Department of Fish and Game has been conducting studies in Suisun Marsh to establish usage patterns by Salt Harvest Mouse. No sitings were made on the Montezuma site during the study period nor have previous trapping studies conducted for PG&E on an adjacent property found any evidence of the Salt Harvest Mouse. The site contains no habitat which would possess ideal conditions (tidally influenced pickleweed). The marshy zones along the river bank, which represent the only possible habitat on the site, have been excluded from any development as outlined in Chapter VII Mitigation Measures.

Neither the Bald Eagle or the Peregrine Falcon, both endangered species, were sited in the Suisun Marsh except during late fall and winter months which indicates the area is used for feeding (PG&E Terrestrial Study, 1974). No nesting sites were observed. Some feeding territory would be destroyed during the construction phase, but the birds could be expected to hunt in surrounding areas still under agricultural practices.

Studies have been conducted specifically to search for the rare California Black Rail (Laterallus jamaicensis coturniculus). The Rail census, taken at night with tape recorded rail calls, found both Virginia and Sora Rails present. The California Black Rail was neither heard nor observed on site. The Rail's presence has been established in the Suisun Marsh where it inhabits the salt marshes. There are a few such salt marsh areas on the site which were the major areas surveyed during the Rail census. These areas as outlined in EIR Chapter VII should be protected.

The Suisun Shrew (Sorex sinuosus) has been known to exist only in the tidal marshes around Grizzly Island, Solano County. Recent studies suggest it might be a subspecies of the Ornate Shrew. The Suisun Shrew was not observed on the proposed site. No large tidal marshes are found on the Montezuma Site. The small patches which might support some habitat are located in the extreme western corner of the site where no construction is planned.

RARE AND ENDANGERED SPECIES WHOSE DISTRIBUTION ENCOMPASSES THE PROPOSED PROJECT SITES

Common Name	Scientific Name
ENDANGERED	
Southern Bald Eagle	Haliaeetus leucocephalus leucocephalus
American Peregrine Falcon	Falco peregrinus anatums
Salt Marsh Harvest Mouse	Reithrodontomys raviventris
RARE	
California Black Rail	Laterallus jamaicensis coturniculus
Alameda Striped Racer	Masticophis lateralis euryzanthus
California yellow-billed cuckoo	Coccyzus americanus occidentalis
STATUS PRESENTLY UNDETERMINED	
Suisun song sparrow	Melospiza melodia maxillaris
Samuel's song sparrow	Melospiza melodia samuelis
Prarie falcon	Falco mexicanus
Burrowing owl	Speotyto cunicularia
Suisun shrew	Sorex sinuosus

IMPACT OF CONSTRUCTION AT MONTEZUMA SITE

As described in the Draft EIR, construction will destroy most of the vegetation covering the six hundred acre site upon which facilities will be built. The important riparian areas along the River will be impacted only in the area of water intake, dock facilities, and pipeline crossing.

Estimates of the extent of permanent destruction of the other vegetation types in the 600-acre construction zone is estimated as follows:

Freshwater Marsh (Seasonal and Permanent)	52 acres
Lowland grassland	67 acres
Upland grassland	298 acres
Total	536 acres

These acreages will be the minimum area upon which facilities will be built. Construction will permanently eliminate existing vegetation from these areas. Landscaping may be done later in selected areas for decorative purposes or screening purposes. The marsh area lost will be utilized for a reservoir storage site which will have significant wildlife value.

EFFECTS RESULTING FROM MODIFICATION OF VEGETATIVE COVER TYPES

Upland Grassland

The major portion of the site and the major loss of habitat will occur in the upland grasslands. These areas have been farmed or grazed for over 100 years and stable seasonal habitat has developed. This vegetation type, consisting largely of barley will maintain its present character if left undeveloped. When the existing agricultural practices are discontinued, the domestic barley will be replaced by forbs and wild grasses with the grasses eventually dominating. Any alteration of existing agricultural practice will affect wildlife. Estimates of their number range from 400 to 1,000 animals per acre, largely mice and ground squirrels. Birds and rodents dependent upon the grassland for food, nesting, or cover would be killed or forced to flee the area once construction started. These bird species include horned larks, meadowlarks, red-tailed hawks, and turkey vultures. Other raptors are dependent upon extensive grassland areas and the loss or parceling of the area would greatly reduce its value as a wildlife habitat. Some animals are known to adapt to man's modification of grasslands; these include the coyote, grey fox, and raccoon.

The minimum loss of about 398 acres of upland grassland (cropped in grain) will diminish the amount of habitat and forage area available for seed-eating birds, rodents, and other animals. This in turn will reduce the numbers of animals present, and those which escape being killed will increase densities in adjoining areas and compete with species living in adjoining undeveloped areas.

Lowland Grassland

Lowland grasslands in the site are less stable than the upland areas and have been the site of dredge spoiling deposition in the past. An estimated 67 acres of this habitat would be destroyed

during construction. Like the upland grassland, this area contains some grains for seed-eating animals (barley) which are among the dominant species. Also dominant are Bermuda grass, Ripgut brome, Filaree, and Fiddleneck. Many of the same species inhabiting the upland grassland are found in the lowland areas. Near water and in the valleys large numbers of ring-necked pheasant are found. As many as 800 of this important sport species is estimated to frequent the site annually. Loss of habitat will cause these birds to use adjoining areas.

Seasonal Marsh

Seasonal marsh will remain a stable vegetation type and serve as an important habitat as long as its water supply remains. Diversion, or alteration of drainage valleys will result in deterioration of the marsh since soil salinity will deter further vegetative growth. New seasonal and permanent marsh areas will be created to compensate for the loss of marshland habitat.

Permanent Marsh

Water supply is vital to the continued survival of vegetation in the permanent marsh. Marshlands eventually become overgrown and the amount of open water eventually declines until it is overgrown. Dow proposed to create a permanent marsh at the eastern portion of the proposed Montezuma site as described in the Draft EIR. Management of this marsh area with technical assistance provided by the California Department of Fish and Game will help maintain a marshland habitat in the area.

CONSTRUCTION IMPACTS AT PITTSBURG SITE

Vegetation

During the month of August and into September extensive land modification altered the riparian, marsh, and parts of the dry grassland areas. The diversion of Kirker Creek and the construction of the diversion channel which relocates the stream to an alternate off-site route, has been accomplished by an extensive excavation and fill project.

The stream and moister areas hosted typical freshwater marsh species which were paralleled by California Delta Riparian. Since most plant species present in these areas need moist soil conditions the diversion of the water supply will eliminate these species and any remaining vegetation will be those adapted to the dry areas present on the lowland grassland area.

The freshwater marsh on the Dow property was small and typical of that type of vegetation. The riparian community lacked a few typical riparian species but formed a unique stand. These areas were important to many bird and mammal species using it for both nesting and feeding.

The diversion channel, built for a different project, will be planted with native California species and a few check dams installed to recreate the habitat lost by the diversion project.

CONSTRUCTION IMPACT ON MAMMAL SPECIES - BOTH SITES

The mammalian wildlife species affected by the proposed project are similar at each site. Impact at the Pittsburg site will be more immediate and permanent, since there are no areas nearby which are capable of readily assimilating any displaced wildlife. The species affected are listed in the species list presented previously in this section. Included are the species found at the proposed sites and the ecological habitat that they are most likely to frequent. Of the 25 mammal species listed, 16 use the riparian ecological habitat, 13 use the grassland habitat, 4 species use the freshwater marsh, and 3 species make use of the structures such as barns which are located on the McOmie property in Solano County. Thus it is apparent that the riparian and Grassland habitats are the most important for mammalian species present on the sites. The riparian habitat at the Montezuma site will be left almost totally undisturbed except for the areas where the loading and unloading facilities will be built. At the Pittsburg site, the riparian areas along Kirker Creek have already been removed as part of a flood control and site preparation project undertaken in August 1975 with the approval of the Contra Costa County Flood Control and Water Conservation District.

OPERATIONAL IMPACTS ON WILDLIFE

Operational impacts on wildlife resulting from operation of the proposed facilities may be both direct and indirect. Emissions from the proposed facilities are not anticipated to result in

any significant increase in airborne heavy metals which could become incorporated into food chains.

Emissions

The emission of gases, oxides of nitrogen, and sulfur dioxide may combine with local moisture in the air from natural fog or cooling tower evaporation to create more acidic rainfall or dew. This in turn may affect local soil acidity with secondary effects on local vegetation. Studies on sulfate and sulfur emissions from large stationary sources is now being investigated by the California Institute of Technology and others with a research grant from the California Air Resources Board and results of these studies should be available for use in mitigating any impacts associated with these types of air quality problems.

The direct effect of emissions on vegetation should be limited as discussed in the section on air quality. Suisun Marsh should not be affected.

Effects of Noise on Wildlife

The effects of operational noise on wildlife should be minor. Wildlife inhabiting areas directly adjacent to roads and rail lines leading to and from the plant sites will experience an increase in the frequency and duration of noise from the increases in vehicular traffic.

Wildlife inhabiting Suisun Marsh should not be adversely affected since rail traffic regularly passes through the areas of the marsh.

Access to Habitat and Territory

The completed facilities will restrict the movement of animals through the area encompassed by the facilities. This impact is of particular concern at the Montezuma site where access to riparian areas is very important. Access should be made available by having fencing placed to avoid preventing animal access to the river front areas except in the immediate area of the dock and loading and unloading facilities.

As is the case on most roadways to which animals have access, vehicles travelling at high speeds, especially at night take their toll on wildlife. Fencing off of roadways has proven to be effective in reducing the number of animals getting onto roadways, but this in turn restricts animal movement which violates natural needs for feeding, shelter, reproduction, and seeking water and other vital needs.

Impacts of Construction of Pipeline Across Lower Sherman Island

Placement of four pipelines across the Island will impact vegetation and wildlife. The Department of Fish and Game has recommended that the three pipelines follow the route of the natural gas pipeline constructed in 1972. This would avoid disturbing an area which has not been previously impacted by pipeline construction. However, there are other considerations involved in pipeline design and location (see Pipeline and Seismic sections). Many special features must be incorporated in the pipeline design to insure its integrity during a maximum probable earthquake. Additional onshore valving or other mitigation features may be required which will require a firm terrestrial footing on the Island.

Loss of vegetation over a 50-foot construction corridor will be complete. Wildlife inhabiting this corridor will be displaced and have to compete for the limited remaining habitat with other resident species and some are likely to perish. Temporary placement of spoils will destroy additional vegetation, burrows, trails, nests, and other wildlife habitat. Noise from construction will disturb wildlife species and frighten migratory waterfowl or resident birds in the area.

Construction Impacts

Aquatic Organisms. Construction at the two proposed sites should not adversely affect aquatic organisms except for the dredging of a turning basin, construction of a dock, and placement of pipelines. The impacts resulting from dredging have been discussed in Chapter V of the EIR.

MITIGATION MEASURES

- Access to habitat areas should be kept open so all animals can fully utilize the undisturbed habitat which remains.
- Measures should be undertaken to provide for wildlife habitat through surface water or brine waste management to create a permanent saltwater or freshwater marsh area.
- Fencing should be constructed in such a manner that animals can get across roadways at specified locations. Vehicle drivers should be instructed via signs to slow down and proceed with caution in these areas.
- Prior to final selection of the location of pipelines which will cross Sherman Island, plans will be submitted to the California Department of Fish and Game for their review and approval. At that time further mitigation measures may be required and detailed impacts of blasting potholes for wildlife enhancement will be assessed.
- Construction of the four pipelines will be done over a route that minimizes the loss of important riparian areas along the levees of Lower Sherman Island and the river front areas.
- Construction measures should be instituted that minimize the destruction of vegetation and habitat areas.
- All necessary permits and approvals will be obtained prior to initiation of any construction activity.
- A positive program to flush out burrowing owls and burrowing animals from the construction areas should be designed and implemented prior to actual earth moving.

REFERENCES

Bakker, E. S., An Island Called California, University of California Press, 1972.

California Department of Fish and Game, At the Crossroads, A Report on California's Endangered and Rare Fish and Wildlife, January 1974.

Jones and Stokes Associates, A Study of the Terrestrial Ecology of the Montezuma Hills Site, prepared for Pacific Gas and Electric Company, January 1975.

Kimsey, J. B., and Fisk, L. O., Freshwater Nongame Fishes of California, California Department of Fish and Game, 1964.

Mallette, R. D., Upland Game of California, California Department of Fish and Game, Second Edition.

U. S. Fish and Wildlife Service, United States List of Endangered Fauna, May 1974.

Economic
Impact X

CHAPTER X

ECONOMIC IMPACT

Several commentors asked for more information on local economic impacts, and particularly on the adequacy of local services such as water and sewer.

The response section on transportation discusses local road adequacy in Solano County. The existing transportation system in Contra Costa County is fully adequate to handle the increases associated with the project. The economic effects of additional growth in Southeastern Solano County are discussed in the chapter on growth inducement.

LOCAL TAX EFFECTS

Tables X-1 and X-2 show the application of the 1974-75 tax rates in Solano and Contra Costa Counties, respectively, to a hypothetical Dow project with an estimated assessed value of $64 million.

As a practical matter, each local taxing entity would have the option of decreasing its tax rate to reduce the cost to existing taxpayers for the same level of service or increasing the level of service at a tax rate equal to or lower than that presently charged. It is interesting to note that the portion of the property tax in Solano County applicable to roads would produce an annual revenue at full project development of $102,000 per year. The rate of project development and associated increase in assessed valuation is important. The project is expected to be completed in a five- to seven-year period with major increases in assessed valuation taking place in the last few years before full operation of the facilities.

SCHOOL FINANCING

The largest single taxing entity in each area is the school district. The Pittsburg Unified School District has an average daily attendance of 6,331 and for the fiscal year 1974-75, a total income of $11.932 million. The local share of this budget is

TABLE X-1

ECONOMIC IMPACT
MONTEZUMA

	Tax Rate	Tax Amount*
General County Tax	2.9363	$1,879,232
Solano County Free Library	.2250	144,000
County Roads	.1600	102,400
Schools		
Community College M&O	.6882	440,448
Community College Bonds	.1016	65,024
Unified (River-Delta) M&O	3.7760	2,416,640
Unified (River-Delta) Bonds	.1640	104,960
County School Service Fund Sup.	.0626	40,064
Equal Aid Offset	.0975	62,400
Other	.1170	74,880
Fire	.1624	103,936
Cemetery	.1307	83,648
Mosquito Abatement	.0600	38,400
Solano County Flood Control	.0798	51,072
Bay Area Air Pollution Control	.0229	14,656
Total	8.7840	$5,621,760

*Assumes assessed valuation of $64,000,000 for new facilities.

TABLE X-2

ECONOMIC IMPACT
PITTSBURG

	Tax Rate	Tax Amount*
General County Tax	2.770	$1,772,800
Contra Costa Service Area F-4	.450	288,000
Contra Costa Flood Control	.020	12,800
County Water Agency	.017	10,880
Mosquito Abatement	.025	16,000
Pittsburg Community Hospital	.200	128,000
Contra Costa Water	.059	37,760
BART	.512	327,680
Bay Area Air Pollution	.016	10,240
East Bay Regional Park	.194	124,160
County School Service	.195	124,800
Pittsburg Unified School	5.141	3,290,240
County Community College	.805	515,200
Total	10.404	$6,658,560

*Assumes assessed valution of $64,000,000 for new facilities

estimated at $7.938 million, the remainder coming from State, Federal, County, and other sources. The primary problem facing the school district would not be the availability of funds to pay for the education of children of additional Dow or related industry employees. Rather, it would be the need for proper planning to accommodate children should any significant immigration occur. As previously discussed, it is expected that most of the new employment would come from unemployed presently in the area including the communities to the west in Contra Costa County.

In Solano County, the River-Delta School District has a 1974-75 budget of $4.277 million of which $3.472 million is from local sources. The average daily attendance is 2,370. If tax rates remained the same, the Dow facility would produce about three-fourths of the School District's current revenues. Obviously, this would provide adequate funding for school costs. Again, the problem would be accommodating a rapid increase in school-aged children. This is not expected to occur with respect to Dow's Solano facility, but could be a problem in connection with major labor-intensive industries.

WATER SUPPLY FACILITIES

Table X-3 shows the status of water supply facilities in the principal communities near the proposed facilities. The basic sources of supplies to all five of the communities shown are adequate to supply significant levels of growth. The costs of water supply improvement have historically been borne on a utility or rate basis and system improvements have not been a problem in any of the communities. However, should growth increases exceed that anticipated with regard to this project requiring significant capital investments, long-term funding programs would be needed.

WASTEWATER FACILITIES

Table X-4 shows the status of wastewater facilities in the five principal communities. Significant problems exist in the Antioch-Pittsburg areas. Present subregional planning in that area could result in the construction of a consolidated waste treatment facility that could handle future needs and provide improved treatment. It is not likely that interim improvements would provide any significant increases in capacity. However, the subregional program anticipates a population growth in the Antioch-Pittsburg area and would be adequate to accommodate any anticipated additional residents arriving as a result of the proposed facilities.

While the Fairfield-Suisun region is now constructing a new regional treatment plant, the long-range capacity is limited and additional investments would be necessary if significant growth occurred in the Fairfield area. This is also true with respect to Vacaville and Rio Vista.

Recent requirements of Federal law and State regulations require that sewer programs be put on a pay-as-you-go basis. That is, utility rate charges are sufficient to pay capital and operating costs. This change would improve the ability of local communities to finance sewer improvements and expansions that would result from any increases in residents.

TABLE X-3

STATUS OF WATER SUPPLY FACILITIES

Community	Source of Water	Facilities	1975 Flows	Remarks
Antioch	Contra Costa Canal & San Joaquin River (about 50:50 usage on a yearly basis).	Raw water reservoir storage. Treatment: chlorination, fluoridation, carbon treatment, filtration, 20 mgd peak flow, capacity.	16 mgd peak flows.	Expansion of treatment and storage units will occur as needed over the next few years. Additional water mains will also be necessary in certain parts of the system.
Pittsburg	Contra Costa Canal.	No raw water reservoir storage. Treatment: flocculation-sedimentation, filtration, chlorination, existing 8 mgd capacity.	Treatment plant at capacity on peak days.	A doubling of treatment plant capacity to 16 mgd is under construction and is scheduled for completion by June 30, 1976. Additional system storage capacity is under construction and more is planned.
Fairfield/ Suisun	Putah South Canal and Vallejo Aqueduct (Cache Slough diversion). North Bay Aqueduct water available in latter 1980's.	Two existing water treatment plants can barely meet the community needs. New plant will be completed this fall. Additional storage facilities are also being completed.	Treatment plants at capacity on peak days. About 16 mgd.	A new 15 mgd water treatment plant will go on line in late 1975 to meet growth needs and water demands at the Anheuser-Busch brewery. With these facilities and new storage capacity the system can handle significant increased demands.
Vacaville	Putah South Canal and wells. North Bay Aqueduct water available in latter 1980's.	Filter canal water, chlorinate all water, 9.5 mgd treatment capacity.	Practically at capacity on peak days.	Additional storage and reservoir capacity is needed and is planned for construction soon. New wells will be constructed in the next two years to add basic capacity. Recent groundwater studies showed no problem in constructing additional wells to meet demand. Existing supplies will meet demand into the 1990's; and by that time, North Bay Aqueduct water is planned to be available.
Rio Vista	Wells.	Chlorination. Well pumps provide peak capacity of 3 mgd. Storage of 2 mg (2 days average supply).	Average consumption is now 1 mgd with peaks up to almost 3 mgd.	Well and pump system is about at capacity. City plans additional wells, pumps, storage capacity, and main construction when it becomes clear where population growth will occur.

TABLE X-4

STATUS OF WASTEWATER FACILITIES

Community	Treatment and Discharge Facilities	Status with Permit Requirements	1975 Flow Conditions	Remarks
Antioch	Primary sedimentation, chlorination, 2.6 mgd average flow capacity. Discharge to San Joaquin River.	Violations of permit requirements due to overloaded plant flow.	Sometimes over capacity.	A connection ban for Antioch is being considered by the Regional Board. Excess primary treatment capacity is available for growth in Pittsburg. A regional sewage plan for the Pittsburg/Antioch area is available in draft form which calls for a regional secondary plant to be located between the two cities. This plant would not be completed until about 1979 and therefore neither city will have secondary treatment by the 1977 statutory deadline. However, interim improvements to the plants are under consideration. Continued growth in Antioch without treatment plant modification will cause worsening primary effluent quality.
Pittsburg (Montezuma and Camp Stoneman Plants)	Primary sedimentation, chlorination, 6.6 mgd combined average flow capacity. Discharge to New York Slough.	Violations of toxicity for both effluents.	About 3 mgd.	
Fairfield/ Suisun	New regional treatment plant (10.35 mgd capacity) will phase out 3 existing plants (Fairfield, Fairfield-Suisun, and Travis AFB).	Three plants operating satisfactorily at present. Regional system will increase treatment level.	About 7 mgd total from 3 plants (Budweiser will add 1.5 mgd in 1976).	The regional treatment plant is under construction and is scheduled for completion in the summer of 1976. Nitrification, effluent filtration, and summer irrigation is planned. If Travis AFB joins the system, additional capacity must be constructed by about 1978 or 1979. If Travis AFB does not join the system, about 4 or 5 years additional capacity is available for planned population growth.
Vacaville	Secondary treatment, discharge to Alamo Creek, tributary to Cache Slough. Plant capacity of 5 mgd.	Satisfactory. New permit calls for zero discharge in the future.	About 4.5 mgd.	Effluent filtration facilities, more effective disinfection facilities and capacity expansion is planned for the near future to meet growth needs and comply with permit requirements. Local irrigation use of the plant effluent is planned, so that winter storage of effluent will also be required.
Rio Vista	Sedimentation.	Satisfactory for primary treatment. Secondary facilities needed.	At capacity.	Plans and specifications have been completed for secondary treatment facilities. The voters are expected to approve a bond election in March 1976 to pay for the local share of the State and Federal grant funded project. The 0.42 mgd facility should be completed in early 1978. An immediate 50 percent capacity expansion may be needed at that time since the 0.42 mgd facility will provide capacity for about 4,200 people. The alternative of building excess capacity at this time is being explored.

MITIGATION MEASURES

- County offices and school officials should make every effort to secure latest industry projections of potential employment, both in construction and in operational phases, as the need for school facilities is considered.

- Community water and wastewater facilities, while currently adequate or under planning for improvement, could be made inadequate as a result of general growth in the area, part of which could come from the proposed facilities. The analysis of local community utility needs should be part of any continuing planning program involving the more regional aspects of industrial development in Southeastern Solano County. This planning effort is discussed in the section on growth inducement.

Williamson
Act XI

CHAPTER XI

WILLIAMSON ACT

Commentors have requested more information on the possible cancellation of the Williamson Act Contract on the Montezuma site particularly consistency with the policies of the Williamson Act and the provision of more information on the economics of agricultural use and the availability of alternative noncontracted lands.

Appendix E of the Draft EIR provides detailed information on the current status of the Williamson Act contract and provides background information for use in deciding on a request for cancellation of the contract. The Williamson Act provides the basis for orderly management of urban and industrial development and preservation of the maximum amount of the limited supply of agricultural land, particularly prime land. The Act is designed to discourage the premature and unnecessary conversion of agricultural land to urban uses, assure the preservation of open space as well as scenic highway corridors and wildlife habitats. The Legislature did not intend contracts on the Williamson Act to be permanent and provided procedures for nonrenewal and cancellation.

The Draft EIR and this reponse provides information to assist Solano County in acting on The Dow Chemical Company's request for contract cancellation. The procedures for removal are described in Appendix E of the Draft EIR.

A variety of factors affect cancellation. This response should be considered with other responses particularly on matters relating to growth inducement, planning, and transportation.

ABSENCE OF INCONSISTENCY WITH PURPOSES

The legislative findings in Section 51220 of the Act provide the basis for evaluating whether an action to cancel a contract is "not inconsistent" with the purposes of the Williamson Act [Section 51282 (a)].

The purposes identified in the Williamson Act contract on the Montezuma site include:

> "WHEREAS, both Owner and County desire to limit the use of said property to agricultural or open space purposes in order to discourage premature and unnecessary conversion of such land to urban use, recognizing that such land has substantial public value as open space and that the preservation of such land in agricultural production or as open space constitutes an important physical, social, aesthetic and economic asset to County; and
>
> "WHEREAS, the parties have determined that the highest and best use of such land during the life of the within contract, or any renewal thereof, is for agricultural or open space purposes."

The contract goes on to specifically make reference to cancellation under the terms of the Act as one means of terminating the contract.

The following comments supplement information provided on Pages E-5 and E-6 of the Dow EIR and are related to the similarly designated legislative intent sections.

Agricultural Use

> "(a) That the preservation of a maximum amount of the limited supply of agricultural land is necessary to the conservation of the state's economic resources, and is necessary not only to the maintenance of the agricultural economy of the state, but also for the assurance of adequate, healthful and nutritious food for future residents of this state and nation."

While the Act does not currently differentiate between prime and nonprime land in terms of the powers delegated to local governments to enter into contracts, it has always contained a definition of prime land, and operative provisions according a preferential status to such land. At the present time, this preference is expressed largely through the State subvention program which since 1972 has subvened eligible contracting local governments at the rate of $1.50/acre for prime land and $0.50/acre for nonprime land. In addition, the statute provides that the payment of any State funds on nonprime lands is conditional

upon the Secretary of Resources finding the existence of a State interest, and that in the event of a shortage of overall funds, the nonprime land has last priority (Section 16140ff). Further, the eminent domain provisions of the Act extend greater protection to prime land than other contracted land [Section 51292(b)]. The clean inference in terms of legislative intent in the context of Section 51220(a) is that while all contracts should be equally enforceable under the provisions of the Act, the level of State interest is graduated in a manner roughly proportional to the relative productivity of the land. The Southeastern Solano County General Plan also makes this distinction in places. The future for crops currently produced on the site depends on market conditions, but current indications are that wheat and barley would have a significant near-term demand; whereas wool, sheep, and, lambs have been in occasional surplus, at least according to industry comments. As the EIR has previously pointed out, these lands are somewhat below Statewide productivity averages for the commodities in question. None of the crops are unique to California or involve a disproportionate California role in national production. There is also no present evidence that the land is well suited to more intensive agricultural use.

Williamson Act contract cancellation would result in reduction of about 25 percent in agricultural productivity at the site, at least according to present Dow plans.

Conversion Impact

> "(b) That the discouragement of premature and unnecessary conversion of agricultural land to urban uses is a matter of public interest and will be of benefit to urban dwellers themselves in that it will discourage discontiguous urban development patterns which unnecessarily increase the costs of community services to community residents."

This policy as it relates to the Montezuma site raises several important questions.

> Premature and Unnecessary Conversion. The Southeastern Solano County 1990 Plan presupposes the existence of industrial development in the area by 1990. Practically, this assumes that industrial development should or is likely to occur in an evolutionary manner over the next 15 years. Economic conditions are changing rapidly.

The timing of a development is not premature if: (1) there is a current economic need for the proposed use, (2) the type of use was generally anticipated at some time during the life of the plan, or (3) it does not by its timing require serious compromising of environmental regulations or force the development of extensive unplanned or otherwise unwarranted services infrastructure.

The need for the use proposed at the Montezuma site has increased dramatically even since the General Plan was approved. The first development in any area likely to create a "chicken-and-egg" problem with regard to preparation of infrastructure and environmental management, but it is unlikely that delaying the development of the Montezuma site until after other industrial development had occurred locally would appreciable alter options available. Actually, the Montezuma site is relatively self-contained from an infrastructure standpoint, being tied by water and pipeline to the Dow Pittsburg site. If Dow elects to make full use of the opportunities for waterborne transportation of goods and materials between the two sites, the Montezuma site could well maintain an existence independent of supporting industrial development and infrastructure on the Solano side more readily than other proposed adjacent industrial developments.

Development on the Montezuma site would be unnecessary if there were another 600 to 2,000 acres (depending on their nature) of usable land could be purchased by Dow in reasonable proximity to its Pittsburg facilities. No other such sites exist as discussed elsewhere. There is a direct relationship between the magnitude of environmental risks of Dow's operation and the distance from the Pittsburg site. The pipeline connection length, although consisting of four, 8-10 inch pipelines in a corridor approximately 40 feet wide, should be reduced to a minimum to avoid possible accidents.

Discontiguous Development Patterns. The amount of undeveloped land that can adequately support heavy industry in California is limited. In the Bay Area, the number of remaining sites exceeding several hundred acres or more is quite limited. One such site exists adjacent to the existing Dow facilities at Pittsburg. Despite attempts to secure the property, it remains unavailable, since its owners have their own industrial expansion plans. Alternatives discussed in Chapter VIII of the EIR have various disadvantages. The principal and

essential transportation artery to the proposed Dow facility is shipping. From the standpoint of water transport, the Montezuma site is essentially contiguous to the industrial zone in Northern Contra Costa County. From the standpoint of the need to connect with other land-based services in Solano County, it is not; although the statuory reference in the Williamson Act is specifically to consequences which "unnecessarily increase the costs of community services to community residents" (emphasis supplied). The General Plan makes it quite clear that the number of residents in the area is negligible, and that the County's intent is to permit only traditional agriculture in the Montezuma Hills behind the water-oriented industrial areas, and in the more productive agricultural areas to the north and east. The announced purpose of this policy is not only to preserve agricultural production, but in accordance with widely accepted planning principles, to create a substantial buffer between heavy industrial uses and the existing urban areas in that portion of the County where the plan proposes that any additional residential development be located. The Plan also indicates that infrastructure in these towns is sufficient to absorb any additional population growth that might be attributable to the Dow Montezuma site, even in the unlikely event that all of its permanent employees were to become Solano County residents. The only significant potential infrastructure problem for community residents is the County road system. The discussion elsewhere provides more information on this subject. While the necessity for assumptions makes any conclusion speculative, the more likely overall impact of the Montezuma site will be to generate, directly and indirectly, increases in assessed value that could be used to reduce the costs of community services to residents.

Related Development. The effect on community service costs of this development is related to the potential for other industrial development occurring as a direct consequence of the Dow development. This is discussed under the EIR section on growth inducement and in these responses. In this discussion, it is necessary to distinguish between development actually attributable to Dow's operations, and any intangible psychological impetus that the approval of Dow's proposal might give to other industrial property owners in Solano County. The nature of the highly industrialized Contra Costa area and its immediate access to highway, rail, and ship transport, as well as Dow's administrative services are likely to result in the location of downstream industries

in Contra Costa County as opposed to Solano County. The products proposed to be manufactured in Solano are not "end" products, but the basic building blocks required for manufacture of chemicals that are in turn used by end-products manufacturers. Thus, intermediate products such as vinyl chloride and polyethylene will primarily be manufactured on the Contra Costa side although at some future time, other needs particularly for styrene products may result in facilities in Solano County. The extent of this subsequent development and its requirements for community services will be evaluated by procedures similar to those now underway before appropriate regulatory bodies in Contra Costa and Solano Counties.

Open Space

"(c) That in a rapidly urbanizing society agricultural lands have a definite public value as open space, and the preservation in agricultural production of such lands, the use of which may be limited under the provisions of this chapter, constitutes an important physical, social, aesthetic, and economic asset to existing or pending urban or metropolitan developments."

The McOmie contract, while probably a form contract, specifically establishes the preservation of open space use as a parallel objective to agricultural preservation. Although both uses and definitions overlap, "open space" use is defined in Section 51201(o) and further explained in Section 51205. That definition, the McOmie contract or Section 51220(c) include recreational use directly.

The proposed facilities will create some encroachment on the open space value of the southern side of the Montezuma Hills. This first significant industrial development will have a significant impact on the visual scene from some locations. The proposed site is not immediately adjacent to a residential area, nor has it been commonly used as a recreational resource or point of access to surrounding property or to the river; so its value as physical or social open space in terms of typical urban development patterns or greenbelting, is limited. Moreover, there is no real shortage of physical and recreational access to large areas of public land and water for either Contra Costa County or Solano residents.

Aesthetically, existing Solano County residents are buffered visually and in other ways (noise, odors, etc.) by the Montezuma Hills themselves, and by extensive agricultural areas beyond them. Residents on the Contra Costa side may have some visual enjoyment of the Montezuma site, depending on their location; but it is from three to ten miles away, and vistas are not uncommonly blocked by existing water-oriented industrial and commercial development on the Contra Costa side, or by the flatness of the terrain. Control of other aesthetic or health-related pollutants is a function of general environmental restrictions, but their presence, if any, would not be unique or even prominent from the standpoint of Contra Costa land use patterns.

Perhaps the most significant current aesthetic value of the site is in relation to transient users such as fishermen and pleasure boaters on the Sacramento River. The visual impact upon these uses will be considerable, but there are various other industrial activities along the banks of the Sacramento River extending all the way to Sacramento including the Clarksburg sugar refinery, the Army Corps of Engineers facility near Rio Vista, and the extensive facilities in Contra Costa County and Solano Counties. A major transmission land of PG&E crosses the Montezuma site. As a result, the visual purity of the immediate area is already impaired.

Significant reductions of visual impacts from some vantage points could theoretically be achieved by moving or rearranging part or all of the proposed facility onto other portions of the McOmie property, or to a lesser extent by landscape or other artificial screening. The benefits of any such mitigating measures would have to be weighed against the economic costs or other disadvantages. Such mitigating measures may be desirable if the trade-offs involved do not make them infeasible. However, given the broader context of the Delta as a recreational resource for the Bay Area Metropolitan region, the Montezuma site is probably less visually critical than many other areas which are currently free of any visual impairment.

Economically, the land as demonstrated elsewhere, has relatively little value in its present use, and the majority of that use will continue for the foreseeable future under Dow's proposed development plan. While the land might be used under the existing contract for compatible recreational uses, it enjoys no unique aptitude for them; and they would in any event be economically and socially nonintensive and therefore insignificant.

Scenic Highways and Wildlife Habitats

> "(d) That land within a scenic highway corridor or wildlife habitat area as defined in this chapter has a value to the state because of its scenic beauty and its location adjacent to or within view of a state scenic highway or because it is of great importance as habitat for wildlife and contributes to the preservation or enhancement thereof."

The definition of a "wildlife habitat area" in the Williamson Act requires a specific designation process by county [Section 51201(j)]. No such designation has been made relative to the McOmie property by the County. The general features of the property in relation to wildlife are treated elsewhere in the EIR.

A scenic highway corridor is defined under the Act [Section 51201(i)] as an area "adjacent to, and within view of" (emphasis supplied) the right-of-way of a state or county scenic highway designated according to certain procedures. State Highway 160 from Rio Vista to Antioch has been designated by the State as a scenic highway. As it crosses Sherman Island, it comes briefly within approximately two miles of the easternmost portion of McOmie property. At that point, however, it is located in a different County (Sacramento) and is separated from the property by at least a mile of farm land and the Sacramento River. It is two miles distant from the Montezuma facility. Moreover, the view of the facility from the highway as it crosses Sherman Island would be partially obscured by the levee on the northwest side of the island. It becomes clearly visible, as the highway becomes elevated at the approach to the Antioch Bridge. At this point, the facility would be about four to five miles distant. Since separation of this nature and distance is not "adjacent", it follows that the McOmie land is not meaningfully within a scenic highway corridor as defined in the Act.

> "The scenic corridor, the band of land generally adjacent to the highway right-of-way, including, but not limited to (1) regulation of land use and intensity (density) of development; (2) detailed land and site planning; (3) control of outdoor advertising; (4) careful attention to and control of earthmoving and landscaping; and (5) the design and appearance of structures and equipment."

This basic definition includes view and adjacency, even though the language of Section 51220(d) subsequently treats them in the alternative. As a practical matter, the historic thrust of the scenic highway program has been the regulation of signs rather than land use, and the visual impact of the facility on the highway would be limited and brief.

To summarize as to the absence of inconsistency with the purposes of the Williamson Act, it would appear the preservation of the McOmie property under the Act has limited value to the nation, the state, or the local community for agricultural production. Given the nature of the proposed change in use, the economic significance of that use, its contiguity to and interconnection with the Contra Costa County Dow facility, and the planned land uses in Solano County, it would also appear that cancellation for proposed purpose would not be inconsistent with the desire to prevent premature urban uses, or unnecessary burdens on community residents. The wildlife habitat areas and scenic highway corridor issues are not problems as defined in the Act. The aesthetic value of the Montezuma site as open space to river users, and to a lesser extent, to Contra Costa County residents, is probably the most significant public value associated with the contract. The adverse effect of cancellation can be mitigated.

In short, the McOmie property, while clearly eligible for Williamson Act treatment, is of relatively marginal value to the public. Since to argue that the existence of any qualifying characteristic of the land would preclude a finding of noninconsistency (since that would render the legislative inclusion of cancellation provisions in the Act, and since involuntary transfers or changes in land use are the basis for a narrower category of cancellations in which the fee may be waived), it follows that a local government has some latitude to change its priorities in the light of changed circumstances, particularly if the public values provided by the property are minimal. The McOmie property would not seem to offer insurmountable obstacles in this regard.

THE PUBLIC INTEREST

A determination of the public interest in the cancellation of a Williamson Act Contract can involve almost as many factors as there are situations and the local discretion with regard to findings is, with two exceptions, unlimited. Typically, however, the question boils down to weighing the relative benefits of the

contract against the benefit of immediately eliminating its restrictions in favor of some other use. With the McOmie property, the economic equation is relatively easy to make in terms of the benefits under current restrictions. The basic formula merely requires the projection of the gross commodity income from the land which will not be farmed by Dow for the next nine years (since Dow could elect unilaterally to be free of the restriction by serving notice of nonrenewal). The calculation of gross income from the Dow facility over the same period is much more complex, but the magnitude of the difference both directly and in secondary benefits is obvious. An analysis of public revenues can be made by comparing the revenue projections over the next nine years (under either an effective or nonrenewing contract given an estimated tax rate) with the increased assessed value placed on the land after cancellation over the same period, and the improvements as they are developed, multiplied by the same tax rate, or by a lower tax rate, if it is estimated that demands for services will remain constant. The cancellation fee (which goes to the State rather than the County) should also be added. In this connection, it should be noted that the Williamson Act has come under considerable criticism for being used in admittedly transitional situations. (See the Environmental Defense Fund response and Assembly Task Force on Preferential Assessment of Property, Preferential Assessment of Agricultural and Open Space Lands (1975) p. 23). Were the County to determine that its 1990 industrial goals were valid but the Dow facility was premature, it could be criticized for allowing a tax break on the property in subsequent years while it was ripening.

Environmentally, the problem is more difficult because it is more intangible. To begin with, the values of protecting the land in its undeveloped state have to be weighed against the benefits of development. This in turn requires that the new use, in this case the Dow facility, be weighed in terms of its public economic benefits which are presumably substantial along with any environmental advantages against its demonstrable adverse environmental impacts, mitigated or unmitigated, and any environmental risks involved. As indicated previously, the positive environmental advantages of preserving the contract restrictions on the McOmie property, while probably greater relative to the Act's stated purposes than the economic benefits are still minor relative to the magnitude of the impacts of all types associated with the proposed facility. Thus the public interest decision in this case will probably turn primarily on the weighing of these latter impacts.

NONGROUNDS

The Act includes two limitations upon the discretion of the board to make its findings of the absence of inconsistency and the public interest.

Uneconomic Character

The cancellation reference to the fact that the uneconomic character of existing land use should only be used as a reason for cancellation if there is no reasonable or comparable agricultural use to which the land may be put would seem to be directed as a deterrent to cancellation proposals based upon the hardship argument that a particular crop or crop pattern is temporarily or permanently unprofitable in a given situation or when an alternative crop pattern arrangement might in fact be economical. The language of the Act requires that such an argument be supplemented by a determination that no other equivalent ("reasonable comparable") agricultural use is possible. Given the incredible diversity of much of California's more productive farm land, this test can be hard to meet although the standard of reasonableness permits the board some discretion. The concept of comparability requires some consideration of potential equal or higher alternate uses. Dow has not claimed that the contract should be canceled due to "uneconomic" agricultural use. Nevertheless, the economic nature of the existing operation is of interest.

Table E-2 of the Draft EIR has been amended by Table XI-1 with the assistance of the County Director and Farm Advisor of the Solano County Cooperative Extension. The current land management practice using about 900 acres each for cropping, grazing, and dormant purposes is the basis of this and previous calculations.

- The total value is estimated at $40,500 in 1974 prices. The income from stock sheep has been figured from the number of ewes culled for slaughter annually, about 20 percent of the breeding stock. Current prices for cull ewes range from $10.50 to $12.50 per head. If all 20 percent of the 1,000 ewes were sold annually at these prices, the annual gross income from 200 cull ewes would range from $2,100 to $2,500.

TABLE XI-1

ESTIMATED 1974 NET AGRICULTURAL VALUE
MONTEZUMA PROPERTY

Operation	Seven-Year Average Quantity	Income $	Cost $	Net Profit $
Dry Farm[1]				
Wheat	300 T	46,800	22,560	24,240
Barley	500 T	57,000	37,600	19,400
Subtotal		103,800	60,160[2]	43,640
Sheep Ranch				
Sheep	1,000 hd	2,500		
Lamb	1,150 hd	44,050		
Wool	7 T	10,220		
Subtotal		56,770	46,770[3]	10,000[4]
Total		160,570	106,930	53,640
Per Acre		59.47	39.60	19.87

Source: Quantities - Table E-1, Draft EIR.
Unit Values, Income Estimates - Table E-2, Draft EIR as amended.
Cost Estimates - Cooperative Extension, University of California, Solano County.

[1]Based on 1963 wheat production data from the Montezuma Hills area of Solano County; cost per cwt @ 22 cwt yield = $2.51.
[2]Total cost estimates increased by 50 percent to 1974 levels.
[3]Includes cost of replacement ewes, feed, taxes, shearing, etc.
[4]Net profit for sheep ranch operations (stock sheep, lambs, wool) figured at $10 per breeding stock ewe per year; income from wool is almost entirely offset by the costs involved in shearing, bagging, etc.
[5]Based on a total of 2,700 acres.

- The gross income from lambs in 1974 is based on the assumption that two lambs are equivalent to one hundred weight (cwt), and a unit price of $38.30 per cwt was used to figure the total. However, the unit price represents the price per cwt of a live lamb, which weighs close to 100 pounds. The total income from lambs for 1974 would then be about double the estimate on Table E-2 or $44,050.

- Using the revised estimates for income from cull ewes and lambs, the gross agricultural income from the Montezuma property in 1974 would then be estimated at $160,570 or $59.47 per acre. Similar adjustments should be made for previous years.

Under the current lease arrangement, the Lessee pays $10 per acre or $27,000 per year to the owner. Thus the before tax theoretical profit would be $26,640 per year. The 1974-75 taxes paid (based on a "Williamson Act assessed value") were $6,540.62. Analysis of past records has shown that during the period from 1962-1972 (comparatively low farm prices) the income averaged less than $25,000 per year exclusive of management costs.

No higher agricultural use of the property appears possible as shown by soil characteristics, the cropping patterns on surrounding land, and related information elsewhere in the EIR. The extent and configuration of the 300 acres of prime land would make it difficult to achieve a higher use and a portion of it is subject to Federal easement for dredging spoils.

While gross income and expense figures can be developed with some readiness on agricultural land, they can produce widely differing net figures depending upon the method used to capitalize the land and its return. This is typically a greater problem on nonprime land than prime since the spread between an income-based value and a market value is generally greater. Few nonprime or grazing operations, even in remote areas, can show a profit based on market value capitalizations and a reasonable rate of return on investment. In effect, any net return discussions would be unreliable in that they would of necessity be based upon arbitrary assumptions.

Proximate Noncontracted Land

Cancellation cannot be based on opportunity for an alternative use not permitted under the contract unless no suitable proximate noncontracted land is available. The Dow cancellation petition is based upon the desirability of a higher use and the unique suitability of the contracted parcel for that use.

Table XI-2 provides a comparison of the characteristics of uncontracted land in the proximity and gives a reference base with regard to the characteristics of the contracted land. The comparison is based on the following:

- Shipping is best provided by direct access to deep-water channels on the Sacramento River with a channel depth which currently exists, i.e., 30 feet. The McCormick property further upriver increases the travel time between the Pittsburg and Solano Dow sites. An important factor for this project is the land proximity to Pittsburg to reduce the length of interconnecting pipelines (quantities of gases that would be discharged to the atmosphere in the event of a pipeline break, as well as the cost of the piping facilities and maintenance factors associated therewith). All of the sites considered here would meet the Act's test of proximity to the proposed site.

- The land character and size are significant factors in that if the terrain is rugged, a larger area is required and it is desirable to have at least 600 acres of usable industrial land for Dow's initial phase of development. In addition, depending on the location, it may be necessary to acquire additional property for buffer purposes. Using these criteria, the National Steel and Montezuma sites are best. The PG&E property and U. S. Steel Pittsburg site are adequate.

- The spill risk factor (see Accidental Spill discussion) is designed to compare alternative sites with regard to their characteristics in the event there should be a spill at the loading facilities or on the site that could not be controlled as a result of the planned design features. Giving primary emphasis to the impact on the Suisun Marsh and Delta riparian habitat as well as dilution factors associated with flows in the Sacramento-San Joaquin Rivers at Suisun Bay, a rating was developed which indicates that

TABLE XI-2

USE CHARACTERISTICS OF LAND NOT UNDER
WILLIAMSON ACT CONTRACTS
MONTEZUMA SITE

Property Owner	Parcel Number Fig. E-2	Shipping Access	Pittsburg Proximity	Land Character and Size	Spill* Risk Factor	Alternative Use
National Steel	1	Good	4 miles	Ample	9	Steel or general/ manufacturing (zoned industrial)
PG&E	7	Good	4 miles	Adequate	5	Power plant site (zoned industrial)
S. Pacific Land Co.	8	Good	4 miles	Marginal	4	Unspecified industrial
Butler	2	None	5 miles	Marginal	8	Industrial/ agricultural
McCormick	16	Fair	8 miles	Marginal	10	Industrial/ agricultural
US Steel (Pittsburg)		Good	Adjacent	Adequate	3	US Steel plans expansion
Dow Montezuma Site	9	Good	4 miles	Ample	2	Industrial/ agricultural

*Based on a scale of 1 to 10 with increasing adverse effects if a spill should occur, considering dilution (tidal and outflow) and nearby resource and habitat significance.

the Montezuma site is better than the Pittsburg site since it is near the confluence of the Sacramento and San Joaquin Rivers where maximum tidal interchange would take place. The McCormick property is on the Sacramento River so that any spill would be diluted only to the extent that flows in the river exist. During certain seasons, the tidal excursion results in very limited net outflow. The offsetting thus is the automatic confinement of any spill. The National Steel property, is immediately adjacent to Suisun Marsh. While development on that site is likely to require failsafe facilities against accidental spills, proximity would make it less desirable than the proposed Dow Montezuma site.

- Perhaps the most important factor in a practical sense is the intention of property owners with regard to their use and development and the effect on those plans of any attempt by Dow to acquire the property. These are the basic reasons why Dow was unable to utilize the Collinsville or adjacent Pittsburg sites. In the case of National Steel, the Company has been planning a steel manufacturing facility in the area, and in furtherance of those plans, sought and was granted specific exclusion from the buffer controls in the recently passed Suisun Marsh Preservation Act. PG&E has, for years, been planning a power plant at the Collinsville site. It successfully sought a designation in the Energy Conservation and Development Act of 1974, and is continuing to pursue development of that site for power generation, most recently proposing coal as an energy source. These two legislative actions indicate a State concurrence in the commitment of land in the area to industrial use. Southern Pacific Land Company has not publicly identified its development plans. This is also true with regard to the Butler and McCormick properties. The U. S. Steel property in Pittsburg is planned to be the site of that company's integrated steel facility. Companies who have their own plans are not likely to sell to others at any price. Likewise for Dow, given the capital-intensive nature of the proposed plant, and the complex set of site requirements, it is not likely that price would be the dominant consideration in site selection.

- There are portions of Sacramento County and Western Sherman Island that would offer sites large enough and adequately sewered for industrial development. For a variety of factors, these sites would be difficult to develop. They have unique environmental and ecological

characteristics, are zoned and planned for recreational and open space uses, and are prime agricultural areas. Development would have serious structural problems as well as the potential for flood hazard.

In Contra Costa County east of the developed areas of Antioch and Pittsburg, there may be land presently in prime agricultural use which could be developed for industrial facilities and provided access to the dock and ship channel. This land would be relatively distant from the Dow facility and have a number of disadvantages, particularly with regard to impact of potential spills.

The Williamson Act cancellation provisions do not require a review of other contracted parcels. A number of parcels to the northeast are under contract. In summary, it would appear that on the evidence available, the board might have the discretion to consider in their public interest and noninconsistency findings, the specific use proposed by Dow on the basis that no other suitable (the term "suitable" must include legal availability or else the whole provision would be meaningless), proximate (technically "proximate" to the McOmie site but practically proximate to Dow-Pittsburg) noncontracted land exists.

CUMULATIVE IMPACT

Discussion in the EIR and in these responses on growth inducement contains information related to the precedent and effect of converting this land from agricultural to industrial use. If the contract is canceled, it would be one more formal indication by Solano County that it plans to convert the property in that area to industrial use. It could conceivably have an indirect psychological effect on contracted land adjacent to the communities of Fairfield, Dixon, and Rio Vista where development pressures probably not from the Dow facility alone but in combination with other proposed developments would put pressure on land owners for nonrenewal or cancellation.

Solano County has stated its intentions relative to having future industrial uses along the southeastern county shore area to the distribution of ensuing residential uses and the use of agricultural buffers to separate the two with some repetition and emphasis in the General Plan. It is also interesting to note that the

Plan (pages 93-95) develops the concept of consolidated deep water port facility at Collinsville for industrial service in the County. See Figure XI-1. That plan contained its own contingency EIR at the time of adoption.

SIZE OF CANCELLATION

Williamson Act contract cancellation has been requested for the entire McOmie property. Although the law is not entirely clear, it implies that the County must act to approve or deny the petition in the size presented and may not reduce (or expand) it without the owner's consent. The County could, of course, deny the petition as submitted with an indication that it would entertain an amended petition in terms of size.

As a practical matter, the choices available to both parties are:

1. Cancel the entire parcel as proposed

2. Cancel only on the acreage needed by Dow for development over the next ten years

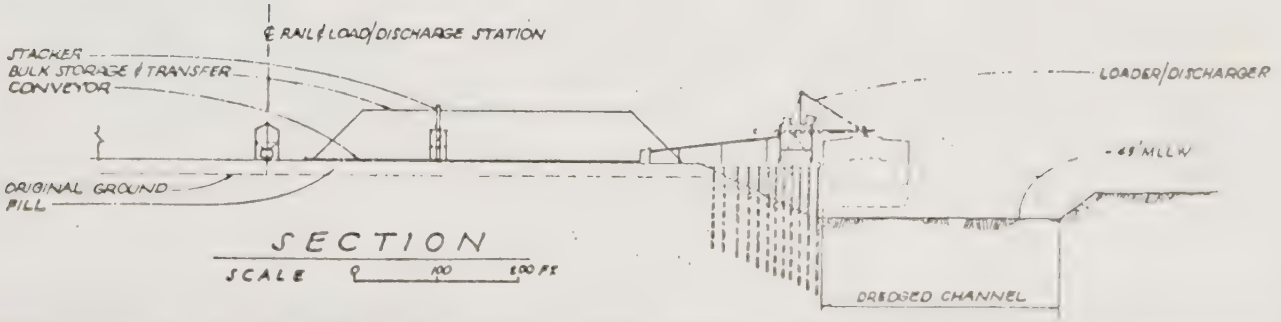
3. Cancel on some larger acreage than option #2 but exclude all lands designated by Dow as permanent agricultural buffer areas

Notice of nonrenewal on any noncancelled portions of the McOmie land could be served at any time by either party, although the Act appears to grant the board the power to refuse to accept cancellations of less than the entire remaining parcel (Section 51245).

There would seem to be little incentive for the County not to accept the petitioner's request for total cancellation if it makes a determination that any cancellation is warranted. In doing so, it will have presumably determined to proceed with industrial development and rezoning on the Montezuma site. Its zoning powers, however, exist wholly independent from its LCA authority; and thus can be exercised to retain A-20 or some similar appropriate zoning control on any portion of the property not immediately required by Dow for development. Since the primary use of the property would then become industrial and the agricultural use residual even if extensive, there is merit to the petitioner's argument that both they and the County would

FIGURE XI-1
DIAGRAMMATIC PLAN OF DEEP DRAFT BULK PORT
AT COLLINSVILLE, CALIF.





be subject to criticisms alluded to earlier if anything less than a complete cancellation were arrived at. Certainly, the financial returns to the County in terms of long-term tax revenues and to the State in terms of the cancellation fee should each be substantially greater. Against these arguments would be the contention that continuation of the contract, at least as described in option #3 above, might provide added leverage to the County to discourage Dow from proposing future revisions of its current agricultural buffer plans.

CONCLUSION

In conclusion, it is clear that the powers of the Williamson Act intended phase out of contracts through nonrenewal to be the basic form of terminating contracts. However, cancellation provisions were put in to permit immediate termination when the "continued dedication...to agricultural use is neither necessary or desirable for the purposes of (the) chapter." (Section 51280) The local option character of the Act's implementation makes it apparent that local governments were intended to have the basic authority to interpret the purposes of the Act and their application within their respective jurisdictions. In spite of the fact that about 30 percent of all privately owned land in the State is under contract, cancellations have been statistically insignificant. Figures compiled by one recent critic of the cancellation procedures indicated that 52 cancellations totaling 12,595 acres occurred from 1967 to 1973 (S.I. Schwartz, et al., Measures for Strengthening the California Land Conservation Act, p. 66), or slightly less than 1/100th of one percent of all the land currently under contract. Conversations with Resources Agency officials indicate that those that have occurred have not infrequently been the result of misunderstandings or miscalculations in the implementation of the program and related planning programs.

In the instance at hand, the energy crises and business recession may be two specific developments which force a reevaluation of assumptions honestly held by land owners, industrialists, and public officials when the land was first contracted. The wisdom of a cancellation or of the subsequent rezoning that would permit the undertaking proposed by Dow are separate, discretionary, and potentially different questions from the question of whether the facts in a given situation appear to meet the minimum statutory requirements upon which cancellation findings could be based. Here it appears likely that the requirements have been met and the future policy options are available to the Board of Supervisors.

MITIGATION

There are a variety of measures that could mitigate the effects of canceling the contract on the property.

- To improve the contiguous nature of this particular facility to other industrial urban developments and reduce secondary impacts, waterborne transportation could be developed between the existing Pittsburg and Montezuma sites for personnel or other goods and supplies. This transportation link would reduce the demand for public facilities in Southeastern Solano County and would facilitate the ability of current Dow employees involved with the Pittsburg plant to continue to reside in Contra Costa County.

- The Montezuma facility could be relocated on the site to take better advantage of the opportunity provided by the terrain for a visual buffer. This would have adverse environmental and economic effects that would offset its aesthetic benefits.

- It appears possible that because of existing taxing boundaries, neither the demands for services nor the tax base is likely to coincide precisely with impacts of the proposed development; and if major inequities appear, some interjurisdictional revenue sharing methods might be developed. The operation of the existing school equalization law, the open space subvention program and SB 90 will to some extent compensate for such inequities automatically. As developed in the Draft EIR, it is not likely that the demand for services by Dow-related employees will have a detrimental effect on existing communities and in fact is likely to have significant benefits, particularly in contributions to the countywide welfare and public service programs, and to the River-Delta School District.

Seismic XII

CHAPTER XII

GEOLOGY, SOILS, AND SEISMICITY

INTRODUCTION

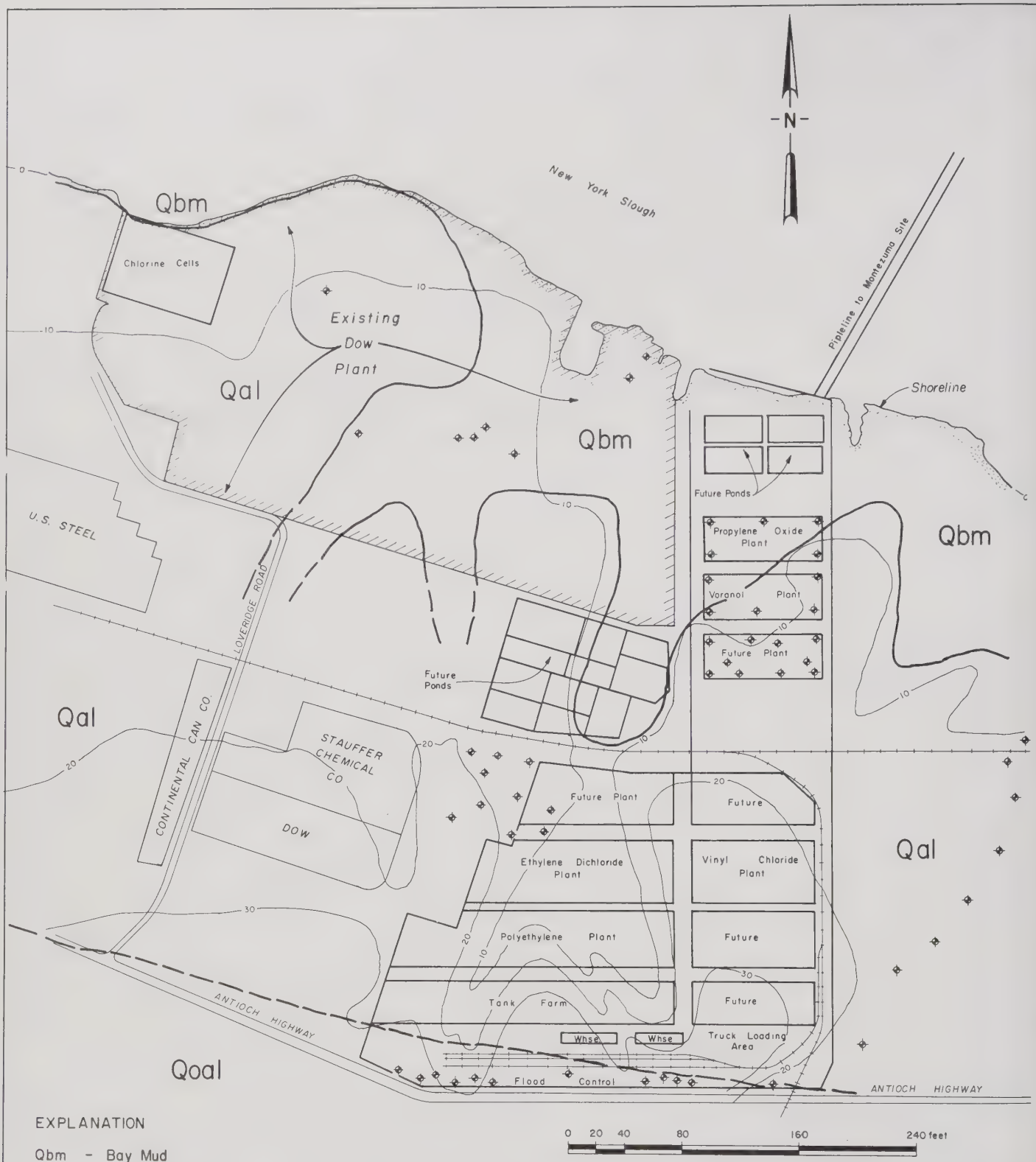
Comments on the geology, soils, and seismicity sections of the Draft EIR generally took the form of requests for more information or more detailed discussions regarding the following matters:

- Site plans and geologic maps
- Description of site preparation and grading
- Discussion of most significant subsoils
- Seismicity
- Geologic and soils impacts; compatibility of local geology with development plan
- Seismic impacts, particularly on pipelines

Additional information on these matters is provided in the following subsections.

SITE PLANS AND LARGE-SCALE GEOLOGIC MAPS

The plant layout, existing topography, and site geology are shown on Figures XII-1 and XII-2 for the proposed Pittsburg and Montezuma plant sites, respectively. The source of the geologic mapping of the Pittsburg site is Harding-Lawson Associates (1975). The borings shown on Figure XII-1 were drilled at various times in the past 20 years for Dow by Dames and Moore and Harding-Lawson Associates. The source of the mapping of the Montezuma site is Woodward-Clyde Consultants (1975c); borings shown on Figure XII-2 were drilled during 1975 by Woodward-Clyde and by Harding-Lawson.



EXPLANATION

Qbm - Bay Mud

Qal - Alluvium

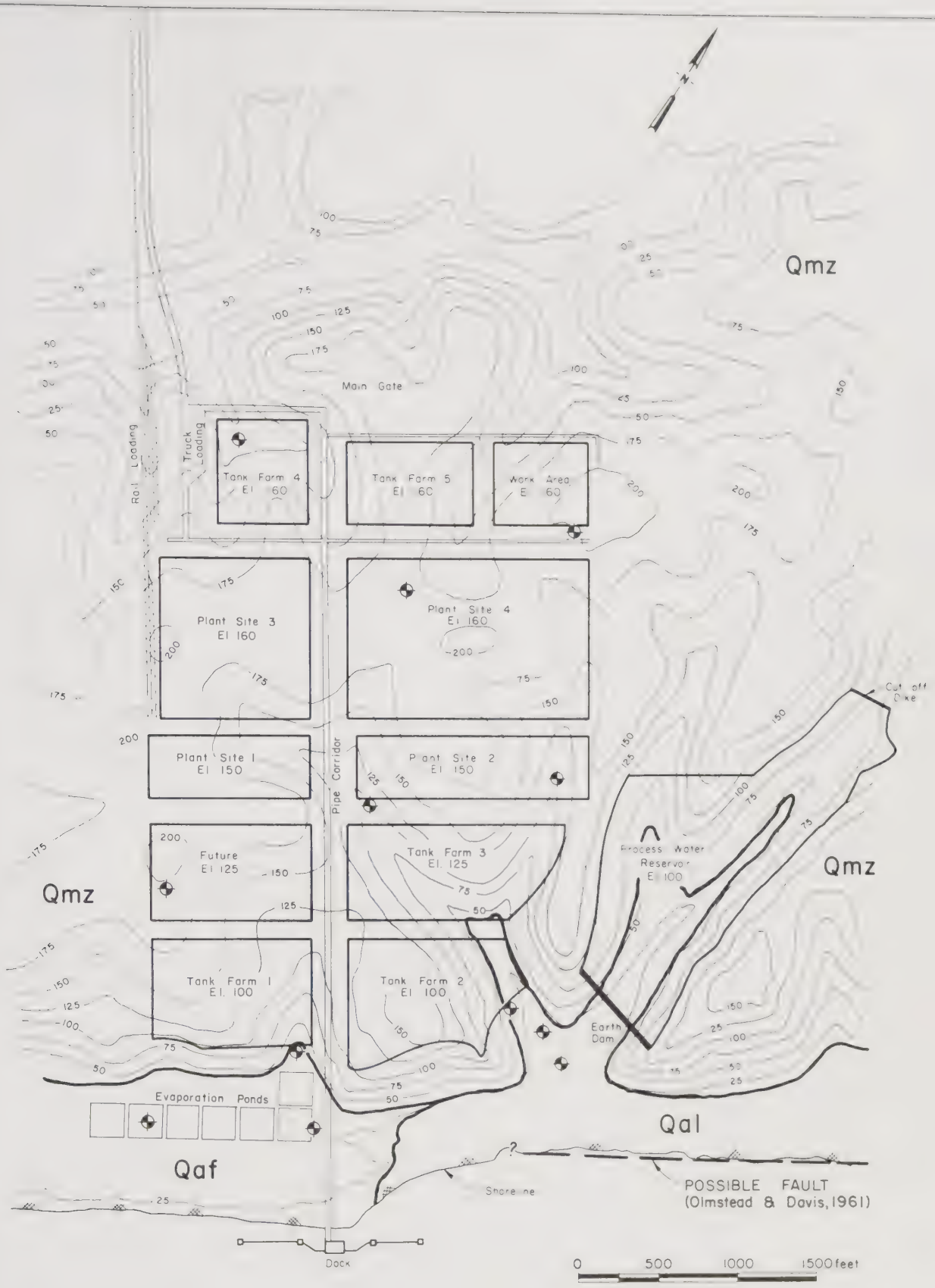
Qoal - Older Alluvium

◆ - Borehole Location

NOTE

Topography shown is based on 1953 U.S.G.S. map of Antioch North Quadrangle.

FIGURE XII-1
PLANT LAYOUT, GEOLOGY, AND TOPOGRAPHY-PITTSBURG SITE



EXPLANATION

Qaf - Artificial Fill

Qal - Alluvium

Qmz - Montezuma Formation

⊕ - Borehole Location

FIGURE XII-2
PLANT LAYOUT, GEOLOGY, AND
TOPOGRAPHY-MONTEZUMA SITE

SITE PREPARATION AND GRADING

Pittsburg Site

Grading on the Pittsburg site will involve leveling the existing grade by balanced cut and fill of about 200,000 cubic yards of earth plus additional imported fill of about 200,000 cubic yards. Site preparation will involve stripping the top few inches of grass and soil containing roots, and either stockpiling this material for later use in landscaping, or removing the material from the site. Scrapers, spreaders, and compactors would then be used to cut down high areas, haul and spread fill to areas to receive fill, and compact engineered fill.

The thickness of fill at the Pittsburg site will typically be less than 10 feet, although up to about 20 feet of fill will be required to fill topographic depressions such as existing evaporation ponds. The filling will result in a site which slopes gently down toward the River. Final grade will be about Elevation 12 near the River and Elevation 20 near the Antioch Highway. The shoreline would be essentially unaltered.

Montezuma Site

Grading for development of the 600-acre plant area at the Montezuma site will involve about six million cubic yards of balanced cut and fill. The graded site will consist of a series of four stepped terraces as shown on Figure XII-2. The lowest terrace would be at the southeast end of the plant area near the dock facility while the highest terrace would be at the northwest end near the rail and truck loading area. Finish grades for the four terraces are tentatively set at Elevations 100, 125, 150, and 160; the rail loading area will be at Elevation 150.

Figure XII-2 shows finish grade elevations in the plant area as well as existing topography. Cuts and fills will be up to 100 feet in thickness. The approximate maximum depth of cut and fill for each part of the plant area is summarized below:

Area	Max. Depth of Cut (feet)	Max. Thickness of Fill (feet)
Evaporation Ponds	5	10
Tank Farm 1	80	60
Tank Farm 2	60	80
Future	80	10
Tank Farm 3	30	80
Plant Site 1	50	30
Plant Site 2	35	50
Plant Site 3	40	20
Plant Site 4	40	40
Tank Farm 4	20	90
Tank Farm 5	30	20
Work Area	50	40
Rail Loading	50	100
Process Water Reservoir	50	25
Earth Dam	25	120

The 600-acre main plant area will require cut and fill slopes up to 100 feet in height around the periphery of the pad and slopes up to 25 feet in height between terraces within the plant site. Inclinations of all slopes will be determined by a soil engineer during the design process, although it is anticipated that slope inclinations will likely be on the order of two horizontal to one vertical.

The process water reservoir east of the 600-acre plant area will require extensive earthfill materials for construction of an earth dam. Cut and fill slopes will separate the reservoir from the plant area, and a small check-dike will form the upstream portion of the reservoir. The earth dam will be about 120 feet high. The maximum reservoir level will be about Elevation 100. Up to 25 feet alluvium will be excavated beneath the dam. Spillway location will be selected during final design, but will likely be through the east abutment or the topographic "saddle" (valley) just east of the reservoir. Details of the dam's design such as slope inclinations, freeboard, spillway capacity, and seismic safety features are not yet available; however, they would be developed later during the design process. By law, all dam design criteria would be subject to review by the California Division of Dam Safety.

The water intake structure located near the eastern boundary of the site along the edge of the River (Figure II-3 in Draft EIR) will be built at about existing grade with only minor grading anticipated.

SOILS

Pittsburg Site

Three geologic units are found near the surface of the Pittsburg site: Bay Mud (Q_{bm}), Young Alluvium (Q_{al}), and Older Alluvium (Q_{oal}). The distribution of these units at the Pittsburg site is shown on Figure XII-1. The most significant soils to the proposed Dow development are the soft Bay Muds and young alluvium which underlie most of the site. Detailed discussions of these two soils follow.

Bay Mud. Bay Mud clearly possesses the weakest engineering properties of any of the subsoils at the Pittsburg site. Bay Mud is present along the northern shoreline, where it is thickest, and gradually thins toward the south until it is no longer present at a position typically 1/4- to 1/2-mile inland from the River.

Structures which will be built in areas underlain by Bay Mud are: (1) the pipeline to the Montezuma site; (2) the future pond areas at the northern and western ends of the site; (3) the propylene oxide plant; and (4) the Voranol* plant.

As shown on Figure XII-1, numerous soil borings have been drilled in the plant vicinity. However, no soil borings have been drilled at the location of the future ponds, although several borings have been drilled in Bay Mud within 1,000 feet of the pond locations. About a dozen borings have been drilled beneath the proposed locations of the propylene oxide and Voranol plants.

The borings suggest that the Bay Mud is less than 50 feet thick near the shoreline, although the Mud could be thicker at other locations. Sporadic fill has been placed over the Bay Mud in some developed areas, incuding the propylene oxide and Voranol plant areas.

Bay Mud beneath the pipeline which connects the two sites is likely about 50 feet in thickness and contains abundant peat at shallow depths. Borings suggest that the Bay Mud near the shoreline grades to a highly plastic silt with depth. Typical engineering properties of the Bay Mud at shallow depths are as follows:

Unified Soil Classification: CH, Pt, or MH
Water Content: 50-250 percent
Dry Density: 15-60 pcf
Undrained Shear Strength: 200-1,000 psf
Compression Index: 0.82 (one test only)

*Voranol is a trade name for polypropylene.

Bay Mud beneath the future pond area at the northern end of the Pittsburg site is likely similar to that described above. The future pond area along the west side of the plant is likely underlain by less than 10-20 feet of Bay Mud based on borings northeast of the future pond area. The thin Bay Mud is likely similar to other parts of the site, although previous grading in the area may have resulted in excavation of some of the weakest soil.

Numerous borings have been drilled in the area proposed for the propylene oxide and Voranol plants. The borings suggest that 0-7 feet of poor to moderately compacted sand fill has been placed in this area, and that Bay Mud is present only at some locations. It appears likely that either the Bay Mud is very thin in this area or that much of the Bay Mud has been excavated and replaced with fill. Where Bay Mud is present, it has a thickness of no more than 10 feet, and rarely more than 3 feet. The borings also suggest that the engineering characteristics of Bay Mud in this vicinity are somewhat better than in other parts of the site. The Mud is typically a soft to medium stiff highly plastic sandy clay with a uniform soil classification system designation of CH. Few specific test data are available on its engineering properties because its thickness rarely exceeds three feet.

Groundwater levels within the Bay Mud are usually at about mean sea level.

Young Alluvium. Nearly all of the major plant structures at the Pittsburg site will be located in areas underlain by young alluvium (Q_{al} on Figure XII-1). The deposit is typical of alluvium in that it is a rather heterogeneous mixture of sand, silt, and clay; gravel is rarely found. For the most part, the subsoils within the alluvium are light brown sandy clays, silty clays, and clayey silts with sand. The most typical alluvial soils at the Pittsburg site have a uniform soil classification of CL; pockets of SM and ML are also often found, and in a few borings layers of CH and SP can be found. Atterberg limits of the CH soils tend to plot near the A-line liquid limits between 50 and 60 percent.

More typically, the alluvium is a silty clay (CL) or clayey silt (ML) with a liquid limit on the order of 20-30 percent and a plastic limit of 10-20 percent. It would be unusual to find less than 10 percent material passing the #200 sieve for

subsoils within the young alluvial deposits. Natural water contents are usually between 10 and 30 percent with dry densities on the order of 95-105 pcf. Standard penetration resistances vary widely, but are usually between 10 and 30 blows per foot. Few shear strength data are available. However, based on soil descriptions given on logs of borings, most of the alluvial soils are stiff in consistency and likely have undrained shear strengths between 1,000 and 2,000 psf.

Most granular lenses within the alluvium are silty sands (SM) or clayey sands (SC), although layers of clean sand (SP) are sometimes found. Such granular soils appear to have been deposited in a discontinuous, lense-like manner based on the lack of continuity between closely-spaced bore holes. The thickness of the granular lenses is usually between 5 and 10 feet, although thicknesses of up to 25 feet are occasionally found. The granular deposits are sometimes loose, are more often medium dense, and are rarely dense. Standard penetration blow counts are usually 10 to 30 blows per foot, although some N-values are as low as 5 blows per foot. These granular lenses, where loose and clean, would appear to have high liquefaction potential under a strong ground shaking. However, for the most part, the young alluvium is clayey and nonliquefiable, and liquefiable zones appear confined to relatively thin discontinuous lenses of loose sand. Groundwater levels in the young alluvium are usually about 10 feet below grade.

Montezuma Site

Four geologic units are found on the Montezuma site: (1) Bay Mud (Q_{bm}); (2) artificial fill (Q_{af}); (3) young alluvium (Q_{al}); and (4) older alluvium termed the Montezuma formation (Q_{mz}). The distribution of these deposits at the Montezuma site is shown on Figure XII-2 and also on Figure II-3 in the Draft EIR. Bay Mud is found at the extreme southwest end of the site (Figure II-3 in the Draft EIR), but since no development is planned in that area, further discussion appears unnecessary. Likewise, the Montezuma formation possesses relatively excellent engineering properties and is not a critical geotechnical element. Detailed discussions of the artificial fill and young alluvium follow.

Artificial Fill. Evaporation ponds will be built on the silty sand artificial fill believed to be dredge spoil (Woodward-Clyde, 1975b). The sand is too pervious to retain water, so the ponds will be formed using clay soils from the

Montezuma Hills. The fill is a medium dense, silty sand with predominately medium-sized grains, 10-20 percent silt content, and a standard penetration resistance of 5-20 blows/foot. The groundwater table is below the base of the sand, hence the fill is nonliquefiable. No major structures or extensive grading operations are planned for areas presently underlain by fill.

Young Alluvium. As shown on Figures XII-2 and II-3 (Draft EIR), tank farms, the water intake structure, the process water reservoir, evaporation ponds, and pipelines will be built in areas underlain by young alluvium (Q_{al}).

In the inland areas beneath the terraced plant site and the process water reservoir, the alluvium is predominately a stiff silty clay (CH) alternating with layers of medium dense to dense silty sand (SM) or clean sand (SP) of about five feet in thickness. The undrained shear strength of the clay layers is usually 1,000 to 2,000 psf; the liquid and plastic limits are typically 60 and 20 percent, respectively. The water content is usually 20 to 40 percent and the corresponding dry density 85 to 95 pcf. The water table is found two to five feet below grade.

Sand lenses in the inland areas are rarely clean and usually contain substantial silt or clay. Loose clean or silty sands which are potentially liquefiable were found in one bore hole only from a depth of 28 to 32 feet.

Alluvial soils bordering the River also contain alternating clay and sand layers, although the sand layers are up to 30 feet thick. Clay layers near the River are medium stiff in consistency and contain significant amounts of sand and small amounts of peat. Sand layers are medium dense to dense, coarse-grained clean to silty sands (SM-SP). Near the dock facility, the alluvium is about 70 feet thick.

Shoreline and underwater slopes are generally inclined at about three horizontal to one vertical and are composed of dense silty sands.

SEISMICITY

Chapter II of the Draft EIR contains a discussion of local and regional faults. Presented herein is an expansion of the discussion regarding major local and regional faults and a

discussion of the faults having the most significance to the proposed Dow development.

Local Faulting

As a general summary of local faulting, it should be noted that local faults in the vicinity of the Pittsburg-Montezuma sites (Figure II-4 in Draft EIR) which are reported to be active (movement within the last 11,000 years) or potentially active (movement in the last two or three million years) include these faults: the Antioch fault; the Rio Vista fault; and the western Montezuma Hills (Collinsville) fault. The evidence used for classifying these faults as active or potentially active is inconclusive and is in most cases questionable. The Clayton fault, shown on Figure II-4 in the Draft EIR, is classified as an active-potentially active fault, but it is located 5 to 10 miles southwest of the Pittsburg and Montezuma sites, respectively.

Other faults shown on Figure II-4 in the Draft EIR are not reported to be active or potentially active, although this does not preclude the possibility that these other faults might be active. Other faults which are reported to be active, but which are not located within the area covered by Figure II-4 in the Draft EIR include the Midland fault, the Concord fault, the Green Valley fault, the Calaveras fault, the Hayward fault, and the San Andreas fault. The Midland fault is reported to be active, but the evidence does not meet the criteria furnished by the California Division of Mines and Geology for active or even potentially active faults.

Surface Fault Displacement

It is generally recognized that earthquakes are generated by displacement along faults. Most of the minor or moderate earthquakes are related to subsurface fault displacement. The fault displacement occasionally extends to the surface in the form of surface fault displacement. While fault displacement may have occurred along fault planes within a relatively broad fault zone during past geological time, the more recent activity is generally confined to fault planes within a relatively narrow zone, commonly called an active fault trace. The active zone is generally recognized on the basis of characteristic topographic features, displacement of recent geological deposits, and sometimes on the basis of distortion of engineering structures due to tectonic fault creep. Future fault displacement will most likely occur along the narrow active trace where fault displacement has occurred most recently.

The amount of surface fault displacement which may be associated with a given earthquake may vary with the magnitude of the earthquake and the type of fault movement. Tocher (1958) showed that there is an increase in the amount of surface displacement with earthquakes of larger magnitude. However, the data indicate that surface fault displacement is less likely for earthquakes with Richter magnitudes less than 5-3/4, suggesting that surface faulting is less likely along the fault located along the south side of the Montezuma Hills, even if the fault were the source of an earthquake.

Bonilla (1967) and Bonilla and Buchanan (1970) show that the amount of surface displacement to be expected for a given Richter magnitude is different, depending on the type of faulting, reverse slip, strike-slip, and normal-slip movement on faults. This relationship should be considered when evaluating the postulated fault at the southern margin of the Montezuma Hills which is reported by Olmstead and Davis (1961) to be a normal fault with the south side down. The reported fault along the west side of the Montezuma Hills near Collinsville is also said to be a normal fault with the west side down (Olmstead & Davis, 1961). The Antioch fault is reported by Burke and Helley (1973) to be a right-lateral strike-slip fault. This suggests that any displacement of the two Montezuma Hills faults would produce extension or tension in structures placed across the fault, and that displacement of the Antioch fault would be horizontal with the west side to the north. This horizontal displacement could produce tension or compression depending on the angle at which the structure crosses the fault trace.

Regional Faulting

The greatest preponderance of historical earthquake-related damage which has occurred in the San Francisco Bay Area has been caused by the activity of the San Andreas fault system, including its major branches, the Hayward fault and the Calaveras fault. These faults, which are discussed below, and their potential earthquake effects should be considered in the design of any important structure in the San Francisco Bay Area. The Concord and Green Valley faults are two other active faults which are significant to the project and are discussed under local faults.

The San Andreas Fault. The San Andreas fault, located about 44 miles west of Pittsburg, is the predominant active fault in the San Francisco Bay Area and is, in fact, one of the longest and most active faults in the world. It is more than 800 miles in length, extending from the Gulf of California, in Mexico, to Shelter Cove in Humboldt County, California. Gradual creep and innumerable episodes of movement along the San Andreas fault have resulted in a total cumulative offset which has been estimated to be on the order of 350 miles (Hill and Dibblee, 1953). These movements created the prominent rift zone which is occupied by the Crystal Springs Lakes on the San Francisco Peninsula and by Bolinas Lagoon and Tomales Bay in Marin County. Individual episodes of fault movement occur along distinct, identifiable fault traces within the zone, rather than throughout the entire width of the zone.

The Hayward Fault. The Hayward fault, located about 30 miles west of Pittsburg, is considered to be an active branch of the San Andreas fault. It apparently diverges from the Calaveras fault somewhere south of Calaveras Reservoir, in Santa Clara County, and extends at least 50 miles northward, through and along the western base of the East Bay foothills. It disappears under the waters of San Pablo Bay north of Richmond, and there is no general agreement as to its location north of San Pablo Bay. It has been postulated by some (Brown, 1970) to "jog" to the northeast to connect with the Rodgers Creek fault on the east side of the Cotati Valley, but a strong case can be made on the basis of physiographic trends that it continues directly northwestward along the western side of this valley. The eastward jog was postulated on the basis of rather inconclusive geophysical data (Clement, 1965). The Hayward fault has been mapped by a number of investigators; the most recent and extensive published map of the fault was compiled by Radbruch-Hall (1974).

Tectonic creep, a gradual long-term movement along an active fault trace, is another characteristic of the Hayward fault. Tectonic creep is commonly manifested in the form of cracked and offset pavement, curbs, sidewalks, and walls. The first documented evidence of creep along the Hayward fault was discovered in the Fremont area in 1960 (Cluff and Steinbrugge, 1966), and subsequent investigators have found this phenomenon to be common along the length of the fault.

The Calaveras Fault. The Calaveras fault branches away from the San Andreas fault south of Hollister, and its most active and best located portion extends northward to the vicinity of San Ramon, 20 miles southwest of Pittsburg. The location of that portion of the fault is shown on a USGS map by Radbruch (1968). Beyond San Ramon, the location of the fault is less clear, and several branches may be present. Saul (1973), working in the Walnut Creek area, mapped the fault as a zone encompassing both the Franklin and the South Hampton faults. Earlier maps by Tolman (1931) and Poland (1935) showed the South Hampton fault as the northern extension of the Calaveras fault, and Lawson (1914) mapped the Franklin fault as the northern extension of the Calaveras fault. Radbruch's and Tolman's maps suggest that the Franklin fault splits near Carquinez Straits with one trace continuing northward on either side of Mare Island.

Louderback (1937) and Brown and Lee (1971), on the basis of earthquake epicenter plots, have postulated that the Calaveras fault continues directly northward from Walnut Creek and may join the Green Valley fault. However, the inaccuracies inherent in epicenter plots are such as to make validity of that hypothesis debatable. The observable scattering of earthquake epicenters in Northern Contra Costa County could equally well be taken as evidence that the Calaveras fault zone actually splits up into a series of minor, less active faults. That latter view can be tentatively supported by evidence presented by Bolt and others (1968) that multiple active faults of limited extent are present to the north of San Pablo and Suisun Bays. Moreover, recently revealed information concerning the existence and location of a Concord fault also conflicts with the hypothesis of a direct northward connection of the Calaveras fault from Walnut Creek to the Green Valley fault.

Regional Seismicity

The greatest preponderances of historic earthquake-related damage which has occurred in the San Francisco Bay Area has been caused by the activity of the San Andreas fault system, including its major branches of the Hayward fault and the Calaveras fault.

The earliest recorded damaging earthquake attributed to the San Andreas fault was actually a group, or swarm, of approximately 18 earthquakes which occurred in the summer of 1808, and which

seriously damaged adobe walls (Tocher, 1959). One of the strongest earthquakes to strike the Bay Area occurred in 1838, accompanying surface breakage which extended along the San Andreas fault from San Francisco to a point near Santa Clara. Following an extensive survey of contemporary accounts of the 1838 earthquake, Louderback (1947) concluded that it was no less severe than the San Francisco earthquake of 1906. However, that conclusion does not have the widespread concurrence of other investigators.

Another severe earthquake on the San Andreas fault centered in the Santa Cruz Mountains in 1865, causing landslides nearby. Fissures were reported in areas covered by "man-made" fills in San Francisco, and at least one major building was ruined. A maximum Rossi-Forel Intensity of IX was reported over a wide area.

The earthquake of April 18, 1906, centering on the San Andreas fault north of San Francisco, is generally considered to have been the strongest historical earthquake to occur in the San Francisco Bay Area. It has been assigned a magnitude of 8.3 (Richter, 1958). The San Andreas fault is said to have broken at the surface for a length of 270 miles, and the accompanying horizontal offset was reported to have been as much as 21 feet. The damaging effects were felt over a wide area. A comprehensive study of the 1906 earthquake disclosed that there were substantial differences in the seismic effects, apparently depending upon the site geologic conditions (Wood, 1908).

The Hayward fault is considered to be an active branch of the San Andreas fault. It apparently diverges from the Calaveras fault somewhere south of Calaveras Reservoir, in Santa Clara County, and extends at least 50 miles northward through and along the western base of the East Bay foothills. The most active segment of the Hayward fault is that which lies between San Pablo Bay and the Warm Springs District of Fremont. Surface fault rupture occurred along portions of that fault segment during major earthquakes in 1836 and 1868. The reported lengths of surface fault rupture during those earthquakes are approximately 36 miles and about 20 miles, respectively. The 1836 event is thought to have been the largest with an estimated magnitude of 7-1/4. Contemporary accounts of the 1838 earthquake led Louderback (1947) to estimate that the Rossi-Forel Intensity in the epicentral region was X. Lawson (1908) inferred an intensity of X for the 1868 earthquake. The strongest earthquake attributed to the Hayward fault thus far in this century was the Modified Mercalli (MM) intensity VIII event of May 1933, which is

reported to have knocked down chimneys in the Niles and Irvington area, and caused rock falls which blocked the Niles Canyon Road (Tocher, 1959). This earthquake is said to have been felt over an area of approximately 8,000 square miles (Neumann, 1935).

The Calaveras fault branches away from the San Andreas fault south of Hollister, and its most active and best located portion extends northward to the vicinity of San Ramon about 20 miles southwest of Pittsburg. The location of that portion of the fault is shown on a USGS map by Radbruch (1968). Beyond San Ramon, the location of the fault is less clear and several branches may be present. Radbruch (1968) suggests that the Franklin fault, located about 15 miles west of Pittsburg, is the northern extension of the Calaveras fault.

Studies by the U. S. Geological Survey (Brown and Lee, 1971) show that earthquakes of Magnitude 3.5 and smaller are quite common along the southern segment of the Calaveras fault. However, larger earthquakes which are clearly attributable to the Calaveras fault occur very infrequently. The strongest historic earthquake which is believed to have originated on the Calaveras fault occurred in 1861 and had an estimated magnitude of 6-1/2 to 7. Ground cracking, possibly representing surface fault rupture, was reported to have accompanied the 1861 event.

The Franklin fault segment of the Calaveras fault has been quiescent during recent years and has been categorized as inactive by some investigators. Tolman (1931) indicated that it is active and that it may have been the source of an Intensity VIII earthquake which caused severe damage on Mare Island in 1898.

Holden (1898) has described the April 19, 1892, earthquake that hit Vacaville, Winters, and Dixon in fairly comprehensive detail. He assigns a Rossi-Forel Intensity VIII to the earthquake at Vacaville and states that "Vacaville seems to have been the headquarters for the quake." Perhaps the most significant parts of Holden's report are the observations of the night watchman in Vacaville. The watchman reported "a rumbling sound which came from the hills west of town" and "the motion at first was west to east and then several violent shocks from north to south." Taken by itself, this would indicate that the earthquake was located on a fault west of Vacaville and not on the Midland fault to the east, as has been indicated in an unpublished bedrock acceleration map prepared by the California Division of Mines and Geology (Greensfelder, 1973).

Estimated Future Earthquake Parameters

Of the historic earthquakes felt in the project area, the Antioch-Collinsville earthquake of May 19, 1889, was probably the most destructive. Because of the fact that reported damage from the 1889 event was heaviest in the project area, it is likely that the earthquake was caused by displacement along one of the nearby faults. Other regional active faults which are capable of producing large and more significant earthquakes are located close to the Dow project area. These active faults, which include the San Andreas, Hayward, Calaveras, Concord, and the Green Valley faults, are capable of producing significant ground shaking at the site. Earthquakes occurring along these longer, more active faults may have the potential for more damage to some structures than earthquakes along the shorter, local faults closer to the site. The effects of potential earthquakes occurring along either the local faults or along the regional active faults, should be considered in design of plant structures. Future studies performed in conjunction with plant design will be required to determine which faults would produce the most critical ground shaking.

For comparison purposes, a maximum credible earthquake has been estimated for each of the known active regional faults in the site vicinity based on work by Bonilla and Buchanan (1970), and for each of the local faults although their activity is uncertain. The maximum bedrock acceleration and the estimated duration of strong ground motion at the sites for each of those earthquakes is estimated based upon work by Schabel and Seed (1972) and Bolt (1973). The estimated earthquake data described above is shown in Table XII-1.

The values given in Table XII-1 are for comparison only and are not intended for design purposes. Also, the actual estimated values for site accelerations may vary considerably from the estimated bedrock accelerations due to the effects of materials overlying the bedrock.

GEOLOGIC AND SOILS IMPACTS

The compatibility of local geologic and soil conditions with Dow's land use plan is discussed in this section. Also, any adverse impacts the proposed development might have on geology or soils is discussed.

CHAPTER XII-1

ESTIMATED EARTHQUAKE PARAMETERS
(For Comparison Purposes Only, Not for Design Criteria)

Active Regional Faults	Distance From Site (Miles)		Maximum Historic Earthquake	Maximum[1] Credible Earthquake	Estimated[2,3] Maximum Site Bedrock Acceleration		Estimated Duration (in seconds) of Strong Ground Motion (Bolt, 1973)
	Pittsburg	Montezuma			Pittsburg	Montezuma	
San Andreas	44	48	8-1/4 (1838,1906)	8-1/2	0.2g	0.2g	19
Hayward	25	29	7-1/4 (1836)	7-1/2	0.2g	0.2g	27
Calaveras	17	21	6-1/2 to 7 (1861)	7-1/2	0.3g	0.3g	27
Concord	11	15	5-1/2[4] (1955)	6	0.2g	0.2g	10
Green Valley	16	18		6-1/2 to 7	0.3g	0.2g	24
Local Faults[5]							
Antioch	1	3		5-1/2	>0.4g	0.4g	>8
Vaca	8	5		6-1/2 to 7	0.4g	0.5g	25
Montezuma Hills (South)	2	0		5	0.2g	0.2g	>8
Montezuma Hills (West)	1-1/2	1		5	>0.3g	>0.3g	>8
Sherman Island-Rio Vista	6	2-1/2		-1/2	0.3g	0.4g	>8
Midland	12	9		7	0.3g	0.4g	25
Davis	3-1/2	4		-1/2	0.3g	0.3g	>8
Kirker Pass	3	7		4-1/2	0.2g	0.1g	>8
Diablo	10	14		4-1/2	0.1g	0.1g	>8
Clayton	5	10		-1/2	0.4g	0.4g	>8

[1] The maximum credible earthquake is the maximum earthquake that, in our judgment, appears capable of occurring under the conditions of the presently known geological framework. It is a rational and believable event that is in accord with present knowledge. In determining the maximum credible earthquake, there is little regard to its probability of occurrence, except that its likelihood of occurrence is great enough to be of concern. Maximum credible earthquakes are provided for the local faults and are intended to be used for comparison purposes only. This does not indicate that the faults are active or that they will be the source of future earthquakes.

[2] The maximum bedrock accelerations have been estimated based upon work by Schabel and Seed (1972). They do not give values for sites closer than 2 miles from the causative fault.

[3] Trifunac and Brady (1975) point out that high peak accelerations should not necessarily be associated with a proportionally higher destructive potential. An extended duration of strong ground motion and high accelerations may characterize destructive earthquake shaking, while one or several high-frequency, high-acceleration peaks of short duration may lead to only small or moderate impulses when applied to a structural system.

[4] Source of the earthquake is unknown. The Concord Fault has been suggested as a possible source.

[5] These faults have not been shown by conculsive evidence to be active. In only three cases is there any reports suggesting activity. The Antioch Fault has been reported to be active by the USGS (Burke and Helley, 1973), the Midland Fault has been indicated to be active by Greensfelder (1973), and the Clayton Fault is reported as possibly active by Woodward-Lundgren & Associates (1974). However, these opinions are not shared by everyone in the geologic profession. The activity of these three faults is still open to question.

Pittsburg Site

Figure XII-1 shows the local geology of the Pittsburg site as well as Dow's proposed development plan. Bay Mud possesses the weakest engineering properties of any soils at the Pittsburg site and Dow has sited nearly all their proposed facilities away from Bay Mud areas. Of course, the pipeline to the Montezuma site must cross Bay Mud deposits, but aside from the pipeline, little development is planned in Bay Mud areas. Two future pond areas are located in Bay Mud areas, but these will involve only minor earth dikes and no buildings. The propylene oxide and Voranol plants are planned in semideveloped areas which have been sporadically filled with sand. However, the Bay Mud is typically less than three feet thick beneath these two plants and of only minor significance.

Nearly all the Pittsburg plant will be built on young alluvium. Although the alluvium has "less-than-ideal" engineering characteristics, it nevertheless is satisfactory from a nonseismic viewpoint for plant development. Shallow foundations are likely adequate for small structures while pile foundations would probably be required for heavy, settlement-sensitive structures. This part of Contra Costa County is relatively heavily developed with U. S. Steel, Continental Can Co., Stauffer Chemical Co., and Dow all presently operating major manufacturing plants located in areas underlain by the alluvium. Seismic considerations are discussed in a subsequent section.

Adverse geologic impacts would include altering natural runoff patterns and possibly slightly altering groundwater conditions (the water table might rise a foot or two in areas which are filled). No other adverse impacts, such as possible triggering of landslides, are evident.

Montezuma Site

As for the Pittsburg site, development in Bay Mud areas will be minor; only the pipeline which connects the two sites will be built in Bay Mud. Likewise, development in the artificial fill and young alluvium would be minimized as much as possible. All the major plant facilities will be constructed on the terraced cut-and-fill area underlain by the Montezuma formation. The Montezuma formation possesses very good engineering properties and is by far the strongest, most stable geologic formation present at the site.

Geologic impacts will be minimal since most development will be in the Montezuma Hills which are composed of relatively strong, stable soils. Shallow landslides are not infrequent within the Montezuma formation, but there is no evidence of major landsliding within the proposed project area. However, there is evidence of major landsliding within the Montezuma formation upstream and northeast from the project site. This factor provides evidence that major landsliding is a possibility in the Montezuma formation. *The potential for landsliding on the Montezuma site would be minimized by prudent engineering during the design process, flattening cut and fill slopes to safe inclinations, and setting back structures from slopes. No slopes will be cut or filled near the River, so there is no potential for River scour triggering landsliding in the plant area.**

Groundwater levels would be negligibly affected by the development. Runoff patterns would be altered in the immediate plant area, but this would appear to have very little impact on local geology. *Filling the reservoir could trigger landslides, but the reservoir is relatively small and the risk would be minimized by proper engineering, dam design, and construction which are subject to review by the California Division of Dam Safety.*

Seismic Impacts

Seismically induced ground shaking at the Pittsburg or Montezuma sites could affect overall site stability where unfavorable conditions or active faults are present. The potential for the following seismic hazards is specifically addressed below:

1. Ground surface faulting.
2. Liquefaction of submerged, cohesionless silt, or sand deposits.
3. Differential settlement.
4. Slumping, lurching, or landsliding.
5. Tsunamis and seiches.
6. Strong ground shaking.

*Possible mitigation measures are highlighted in italics.

Ground Surface Faulting. Surface faulting is more likely along faults which have moved recently than along faults which have not been the location of displacement for a significant period of time. Therefore, surface faulting is more likely along faults which are active (displacement within 11,000 years) or potentially active (displacement within last two or three million years) than along other faults. The only faults which are reported to be active or potentially active within the project vicinity include the Rio Vista fault, the Antioch fault, and the fault along the west side of the Montezuma Hills (Collinsville). Therefore, these faults must be considered in the design phase of any structure crossing them..

At the Montezuma site, only the possible fault reported by Olmstead and Davis (1961) along the southeast margin of the site underlies any proposed plant structure. The location and existence of this fault is based upon an oral communication from the U. S. Bureau of Reclamation. The Bureau indicated to Olmstead and Davis that "the bluff facing the Sacramento River is probably a fault scarp." This fault is not included on the State Fault Map by Jennings (1973). Apparently Jennings considered that the evidence for a fault at this location was not sufficient for it to be included on his map. Therefore, there is no conclusive evidence that a fault exists at this location; and, furthermore, there is no evidence that the postulated fault is active.

Based on the evidence, there appears to be a very low potential for surface rupture along the postulated fault at the southeast margin of the Montezuma Hills. However, this geologic feature should be considered prior to construction of facilities across this feature. If there were surface faulting along the possible fault mapped by Olmstead and Davis, only the water intake pipeline would be affected. However, if the intake pipe were severed, water from the process water reservoir would be used to continue plant operations, or if necessary, for plant shutdown.

The water intake pipe is the only structure planned by Dow which would cross the fault mapped by Olmstead and Davis (1961) along the southeast shoreline of the site. However, artificial fill has been placed southwest of the possible fault and has concealed any topographic evidence (if there was any before the fill was placed) that the possible fault continues on to the southwest. Although this possibility appears remote, it nevertheless should be considered.

Based on published data by Bonilla and Buchanan (1970), a reported length of the possible fault equal to three miles, and the magnitude of the maximum credible earthquake equal to five, then the possible fault bordering the southeast shoreline of the Montezuma site would appear capable of up to at least one foot of movement. *The amount and direction of displacement must be considered further during the design phase. The anticipated movements are small; pipelines are often designed to withstand differential movements on the order of one foot. It would appear that flexible design of pipelines leading to the dock could be used to mitigate the hazard of fault movement on the order of one foot. Furthermore, to minimize even further the consequences of surface fault movement, pipelines from the plant to the dock could be equipped with automatic shutoff valves. These valves are designed to automatically close the pipeline if there is a sudden drop in pipeline pressures (a break in the pipeline). Other types of seismic shutoff valves are designed to automatically close whenever ground vibrations reach a preset level. These velocity-sensitive devices offer the advantage of closing the pipeline during strong earthquakes so that the pipeline can be inspected for damage prior to returning it to service.*

If the fault postulated by Olmstead and Davis (1961) were extrapolated southwesterly beneath the artificial fill, it would also pass beneath an area to be developed for evaporation ponds (see Figure XII-1). Dikes forming the evaporation ponds would likely be built of wet, flexible, impervious clays from the Montezuma Hills. *Dikes could be built around the perimeter of the entire evaporation pond area as a back-up system for containment of chemical wastes should a primary dike failure occur from such an unlikely event as surface faulting. Also, the site could be graded so that any spills would flow away from the River and be contained to the north by the Montezuma Hills. Thus, the dikes and pipelines at the Montezuma site could be designed so that in the event that ground rupture occurs due to active fault movement, there is only a remote chance of a failure. Furthermore, the impact of a failure of pipelines could be minimized by seismic shutoff valves, and by site grading in the evaporation pond area so that any spill would be contained on land.*

Ground surface rupture beneath the River due to movement along the mapped Antioch fault could affect the pipeline connecting the Pittsburg and Montezuma sites. For a fault length of about 20 miles and a maximum credible earthquake

of Magnitude 5-1/2, the fault displacement (according to Bonilla and Buchanan, 1970) could be on the order of 1 to 2-1/2 feet. *The amount, direction, and location of displacement must be considered prior to finalizing the design criteria. The anticipated movements would appear to be large enough to require a special design in order to provide reasonable assurance that the pipeline would not rupture. Such special designs are not uncommon. For example, the trans-Alaska pipeline, where it crosses the active Denali fault, is designed not to rupture for a fault displacement of about 20 feet. Shell Oil recently designed a pipeline across the Hayward fault in Oakland to withstand movement on the order described above. Thus, while a rather unique design would be required, such designs are presently being made for more severe displacements than would be expected for the proposed Dow project.*

A special design of the pipeline crossing would minimize the risk of a pipeline failure due to displacement along the possible Antioch fault, but it would not completely eliminate the possibility of a failure. Also, while seismic shutoff valves at the Pittsburg and Montezuma sites would prevent flow into a ruptured pipeline, they would not prevent the contents between the valves from escaping through a break in the line. Thus, the consequences of a break in the pipeline and release of gaseous product from the segment of pipe between the shutoff valves to the River water must be considered.

The pipeline will actually consist of three 10-inch pipes carrying ethylene, propylene, and hydrogen gases. These gases are toxic when inhaled and flammable in large quantities. However, the gases are not toxic to humans or animals when sufficiently diffused in the atmosphere. In the event of a pipe rupture, the gases would bubble up through the River and escape into the atmosphere. There would likely be little effect upon the River since the gases would bubble up quickly and are only slightly soluble in water. For a more detailed discussion of the possible environmental effects due to a pipe rupture, see the section on "Pipelines."

Liquefaction. Liquefaction is a phenomenon which occurs only in loose or medium dense deposits of cohesionless soils located beneath the water table. When subjected to strong ground shaking, such soils undergo what amounts to a complete loss of strength, i.e., the soil behaves as a liquid.

The impact of soil liquefaction depends largely on site topography, the depth of liquefaction, the land use, and foundation systems of any structures. Topography is a very important factor since on flat sites, liquefied soils have no tendency to flow, and the soil behavior is analogous to water on a lake. Conversely, on sloping sites, liquefied soils may undergo mass downhill flow taking everything originally on the surface with the flowing soil.

The depth of liquefaction is important since deep liquefaction on a flat site may not affect light structures founded upon nonliquefiable, near-surface soils. The consequences of liquefaction also depend on land use and other details such as type and depth of foundations for buildings.

A number of factors influence the liquefaction potential of soils. Soils which possess significant cohesion are usually considered nonliquefiable. Thus, all clay deposits, silty clays, sandy clays, clayey silts, clayey sands, or cohesive silts are considered nonliquefiable. Silty sands and silts may or may not be cohesive.

In general, the smaller the grain size of the cohensionless soils the more susceptible to liquefaction the cohensionless soil becomes. Gravels are not as prone to liquefaction as sands which in turn are not as prone to liquefaction as cohesionless silts.

Relative density is a very important factor in liquefaction potential; loose deposits are much more prone to liquefaction than dense deposits. Also, the intensity of ground shaking and duration of strong ground shaking are very important factors affecting liquefaction.

At the Montezuma site, the alluvial deposits within the 600-acre plant area generally have no liquefaction potential because soils are predominately clays. Loose sand lenses of less than five feet in thickness are occasionally found in the alluvium in the plant area, and these pockets of sand have high liquefaction potential under present conditions. However, with site development and grading, the alluvial soils will be buried under about 80 feet of fill, and with the addition of such a heavy overburden, the sand lenses should have very low liquefaction potential. *Any potentially liquefiable soils beneath the earth dam would be excavated prior to construction both for safety reasons and to remove*

any pervious layers beneath the dam which might permit excessive underseepage. Thus, major structures at the Montezuma site will be located in areas where the risk of liquefaction is or will be negligible.

Shoreline areas of the Montezuma site are underlain by alluvial deposits which are both more sandy and less dense in general than alluvium deposited in stream channels cutting through the Montezuma Hills. Borings drilled in the vicinity of the dock indicate that sands predominate in the upper 50 feet of the alluvium. The sands are medium dense to dense with standard penetration blow counts of about 20 near the top of the deposit and 30-40 at depths below the top of the deposit of 20 feet or more. The sands are slightly silty (typically 10 percent passes the #200 sieve) and of fine to medium grain size. About 35 feet of artificial fill overlies the alluvium near the dock. Liquefaction potential appears to be very low below a point 20 feet beneath the top of the alluvium. Liquefaction potential near the top of the alluvium appears low to moderate. Liquefaction potential of slopes beneath the Sacramento River appears low because of the dense nature of these sands.

The only significant liquefaction potential on the Montezuma site appears to be in the upper zones of the young alluvium bordering the Sacramento River. Structures sited in potential liquefaction areas include the water intake structure, the pipeline to the dock, the pipelines across the River to the Pittsburg site, and the evaporation ponds. Damage to these structures, if some of the alluvium liquefied, would depend on the foundation scheme of each structure and whether liquefied soils would undergo mass downhill flow toward the River.

Liquefaction in the vicinity of the water intake structure could cause settlement of the structure and rupture of the intake pipeline. Mass flow is virtually impossible at the water intake location because of the flat topography. Nevertheless, the intake structure could be destroyed with no significant hazard to the plant since water from the process water reservoir could be used for plant operations or safe shutdown.

Liquefaction in the dock area could affect the pipelines leading from the plant to the dock. However, mass soil flow near the dock is considered very unlikely (Woodward-Clyde, 1975b), and since 35 feet of unsaturated fill overlies the alluvium, it appears that liquefaction of the upper zones of the alluvium would not cause gross instability of the pipelines. *The dock itself has been designed to be supported on long piles which would derive their support from deep, nonliquefiable soils. It appears that the only effect from liquefaction in the dock area would be differential settlement of the ground surface as a result of settlement of liquefied soils. These settlements would likely be only an inch or two, and flexible pipeline design would likely prevent pipeline rupture. Seismic shutoff valves would help minimize pollution from any unexpected pipe breakage.*

Liquefaction in the vicinity of the evaporation ponds would likely be confined to the upper 10-20 feet of alluvium which underlies approximately 35 feet of fill. The zone of potential liquefaction also contains layers of clayey silt, silty clay, and sandy clay. It is unlikely that the liquefiable sand lenses are continuous over horizontal distances of more than a few hundred feet. Therefore, it is unlikely that mass soil flow, i.e., a liquefaction-triggered massive landslide of the alluvium into the River, is possible. However, *this would be further evaluated during the final design when additional soil borings are drilled. If, during the final design, such landslides appear possible, a number of measures would be available to eliminate the hazard. These mitigating measures include in-situ densification of potentially liquefiable soils, chemical grouting, and cement grouting.*

The 35-foot thick layer of partially saturated fill which overlies the alluvium should shield the evaporation ponds from excessive post-liquefaction differential settlements. *Proper site grading would provide further assurance that wastes contained in the ponds would not contaminate the River.*

Liquefaction potential at the Pittsburg site is low for all geologic formations present except the young alluvial deposits. Mass downhill flow of alluvial soils due to liquefaction is virtually impossible at the Pittsburg site because the topography is flat and the potentially liquefiable soils

were deposited in discontinuous lenses or pockets. It appears that liquefaction would probably be restricted to layers of loose sand which are usually less than 10 feet thick, but occasionally up to 25 feet thick. Since the water table is about 10 feet below grade, the ground surface itself would not be susceptible to liquefaction.

The consequences of liquefaction in the young alluvium at the Pittsburg site can be minimized by proper engineering design since the risk of massive landsliding or mass soil flow triggered by liquefaction (for which a safe design is rarely feasible) is nil. Building damage from settlement due to liquefaction could be minimized in design by planning a thick pad of nonliquefiable soil beneath lightly loaded structures or designing deep pile foundations for heavy structures.

It would be difficult to design all roads and in-plant pipelines to withstand rupture caused by ground settlements due to liquefaction of subsoils. However, *the consequences of a failure can be minimized by using seismic shutoff valves for pipelines and by grading the site to contain liquid pipeline spills.* Special designs might be required to assure integrity of critical pipelines. For example, a pipeline carrying dangerous chlorine gas will connect the vinyl chloride plant with the chlorine storage cells. Because a serious public hazard could exist if the chlorine gas escaped into the atmosphere, every effort should be made to be sure it will not fail due to liquefaction or as a result of post-liquefaction differential settlement, and that if it did fail, the gas would not escape into the atmosphere. *It might be necessary to utilize deep burial of the pipeline along with a bed of strong, stable, compacted soil to reduce the magnitude of differential settlement. Flexible pipe design would be essential. Back-up systems, such as flexible hoses, might be installed around the main pipe to insure that the gas would be contained in the event of a pipe break.*

Further studies of liquefaction potential at the Pittsburg site would be made during the course of detailed foundation design. If liquefaction potential at any one location is found significant enough to pose a risk of foundation instability or rupture of a critical pipeline, a number of mitigating measures are possible to reduce the consequences of liquefaction. For example, deep pile foundations can be used to transfer structural loads to soils beneath the

potentially liquefiable zone. Other techniques, such as in-place densification of sands, removal of liquefiable soils and replacement with nonliquefiable soils, and cement grouting of subsoils can be used to mitigate serious liquefaction hazards.

Differential Settlement. Seismically induced differential settlement would likely be negligible in the old alluvial deposits at both the Pittsburg and Montezuma sites because of the dense nature of these deposits. Differential settlements of younger alluvial deposits could be of the order of several inches, but would likely not be large enough to adversely affect light, flexible structures founded upon shallow foundations located on a sufficiently thick layer of well compacted fill or strong natural soil. Differential settlements in young alluvial deposits would have a minimal effect upon pile-supported structures which derive their support from deep soils which would likely not settle significantly. It is possible that pavements, pipes, and utilities could be adversely affected if not designed to withstand the seismically induced settlements. *Seismic shutoff valves and proper site grading can both be used to minimize the consequences of any unexpected pipe ruptures. Special designs and back-up systems might be required for critical pipelines or utilities.*

Seismically induced settlements could be large (on the order of several feet) over the soft Bay Mud deposits. Seismically induced fill settlements as large as 11 feet have been observed near Benicia as a result of the 1906 earthquake originating along the San Andreas fault (Wallace, et al., 1907).

No development is planned for Bay Mud areas at the Montezuma site, hence large differential settlements would have no impact on the plant. At the Pittsburg site, large differential settlements could affect fills in Bay Mud areas, but probably not structures since they are located only where the mud is thin and would likely be supported on pile foundations. The northern future pond area would undergo the most severe differential settlement since it is located where the mud is thickest. However, *proper site grading would help retain any spills on the site. The pipelines beneath the River could be adversely affected by large differential settlements in Bay Mud. Again, with pipeline design for fault movement or differential settlement, and with the installation of seismic shutoff valves, the hazard would be minimized.*

Slumping, Lurching, or Landsliding. There appears to be very little risk of static or seismic slope instability at the Pittsburg site because of the flat topography. The only potential for slumping, lurching, and cracking is in Bay Mud deposits located along the River. *In any critical shoreline areas developed for the plant, the potential hazard can be mitigated by structurally supporting slopes; by removal, recompaction and strengthening of shoreline slopes; or by other conventional means.* At this time, no shoreline development is contemplated at the Pittsburg site.

The Montezuma site likewise appears to have little potential for seismically induced landsliding because of the good strength of the Montezuma formation. Shoreline deposits at the Montezuma site could be subject to seismically induced slumping, lurching, or cracking. *This hazard is only significant near the dock, and there it can likely be largely mitigated by proper design.* Since no other major developments are presently contemplated along the shore of the Montezuma site, other than the pipeline crossing, it would appear that slumping, lurching, or cracking of shoreline slopes would have little effect on the plant. Of course, *this would be studied further for final design, and if necessary, mitigating measures such as those described above would be used.*

Tsunamis and Seiches. The potential for tsunamis (tidal waves) of any significant height appears to be nil (Alfors, et al., 1973). Seismically induced seiches should be negligible and would be limited to lakes and reservoirs in the area (Antioch Seismic Safety Element, verbal communication).

Ground Shaking

Seismically induced ground shaking is a potential risk at both the Pittsburg and Solano sites, though it is certainly no greater than at other locations in the general area. *The risk of structural damage caused by strong ground shaking can be largely mitigated by means of existing rational methods of earthquake-resistant structural design. These methods include criteria set forth in such codes as the Uniform Building Code and methods developed recently for modeling by computer analysis the response of the ground and structure to hypothetical earthquake shaking. The method of design would be selected by the structural engineer, upon whom responsibility for adequate seismic structural design rests, during the final design process.*

REFERENCES

Bailey, T. L. (1930), The Geology of Potrero Hills and Vacaville Region, Solano County, California: California University, Dept. Geol. Sci. Bull. 19, pp.321-333.

Bolt, B. A. (1973), Duration of Strong Ground Motion, Proceedings Fifth Work Conference on Earthquake Engineering, June 25-29, Rome, Italy, pp. 1304-1313.

Bolt, B. A., and Miller, R. D. (1971), Seismicity of Northern and Central California, 1965-1969: Bull. Seismol. Soc. of America, Vol. 61, pp. 1831-1847.

Bonilla, M. G. and Buchanan, J. M. (1970), Interim Report on Worldwide Historic Surface Faulting, Open-File Report, U. S. Geological Survey.

Brabb, E. E., Sonneman, H. S., and Switzer, J. R., Jr. (1971), Preliminary Geologic Map of the Mt. Diablo-Byron Area, Contra Costa, Alameda, and San Joaquin Counties, California: San Francisco Bay Region Environment and Resources Planning Study, Basic Data Contribution 28.

Brown, R. D., Jr., 1970, Faults that are Historically Active or that Show Evidence of Geologically Young Surface Displacement, San Francisco Bay Region: U. S. Geological Survey/ Housing and Urban Development Basic Data Contribution No. 7.

Brown, R. D., Jr., and Lee, W. H. K. (1971), Active Faults and Earthquake Epicenters (1969-1970) in the Southern Part of the San Francisco Bay Region: U. S. Geological Survey Map MF-307.

Burke, D. B., and Helley, E. J. (1973), Map Showing Evidence for Recent Fault Activity in the Vicinity of Antioch, California: U. S. Geol. Survey, Map MF-553, Scale 1:24,000.

Clement, W. G. (1965), Complete Bouguer Gravity Map of the Northern Part of the San Francisco Bay Area, and Its Interpretation: U. S. Geological Survey Map GP-468.

Cluff, L. S., and Steinbrugge, K. V. (1966), Hayward Fault Slippage in the Irvington-Niles District of Fremont, California: Bulletin of Seismological Society of America, Vol. 56, No. 2.

Frizzell, V. A., Jr., (1975), New Evidence for Activity on the Green Valley Fault, Napa and Solano Counties, California: in U. S. Geol. Soc, Abs. with Programs, Vol. 7, No. 3, February 1975.

Gibson, W. M., and Wollenberg, H. A. (1968), Investigations for Ground Stability in the Vicinity of the Calaveras Fault, Livermore and Amador Valleys, Alameda County, California: Bulletin of the Geological Society of America, Vol. 79, No. 5.

Goldman, H. B. (1969), Geology of San Francisco Bay in Geologic and Engineering Aspects of San Francisco Bay Fill: California Division of Mines and Geology Special Report 97.

Greensfelder, R. W., 9173, A map of maximum expected bedrock acceleration, with text, prepared for California Division of Mines and Geology, January 9, 1973, Unpublished.

Harding-Lawson Associates (1975), Geological Interpretation, Test Boring Data, Dow Chemical Plant Area, Pittsburg, California: Report to Dow Chemical, April 30.

Hill, M. L., and Dibblee, T. W., Jr. (1953), San Andreas, Garlock, and Big Pine Faults, California: Bulletin of the Geological Society of America, Vol. 64, No. 4.

Holden, E. S. (1898), Catalogue of Earthquakes of the Pacific Coast from 1769 to 1897: Smithsonian Misc. Collections, No. 1037.

Jennings, C. W. ed. (1973), Geologic Map of California: California Division of Mines and Geology, Scale 1:750,000, in preparation.

Koenig-Lawson, A. C. (1914), San Francisco Folio: Geologic Atlas of the United States, Folio 193, U. S. Geological Survey.

Lawson, A. C. (1908), The California Earthquake of April 18, 1906-Report of the State Earthquake Investigation Commission: Carnegie Institute of the Washington.

Louderback, G. D. (1947), Central California Earthquakes of the 1830's Bulletin of the Seismological Society of America, Vol. 37, No. 1.

Louderback, G. D. (1937), Characteristics of Active Faults; in The Central Coast Ranges of California: Bulletin of the Seismological Society of America, Vol. 27.

McAdie, A. G. (1907), Catalogue of Earthquakes of the Pacific Coast from 1897 to 1906: Smithsonian Misc. Collections, part of Vol. XLIX, No. 1721.

Nason, R. D. (1971), Investigation of Fault Creek Slippage in Northern and Central California: PhD Thesis, University of California, San Diego.

Neumann, F. (1937), United States Earthquakes, 1933: U. S. Coast & Geodetic Survey, Serial No. 579 (Reissued 1968).

Olmstead, F. H., and Davis, G. H. (1961), Geologic Features and Groundwater Storage Capacity of the Sacramento Valley, California: U.S.G.S. Water Supply Paper 1497, 241 pages.

Poland, J. F. (1935), Groundwater Conditions in Ygnacio Valley, California: Unpublished A.M. Thesis, Stanford University, Stanford, California.

Radbruch-Hall, D. H. (1974), Map Showing Recently Active Breaks Along the Hayward fault zone and the Southern part of the Calaveras fault zone, California: U. S. Geological Survey Map I-813.

Radbruch, Dorothy H., 1968, New evidence of historic fault activity in Alameda, Contra Costa, and Santa Clara Counties, California, Proceedings of Conference on Gelogic Problems of San Andreas Fault System, Stanford University Publications in Geological Sciences, Vol. XI, p. 46-54.

Reiche, P. (1950), Rio Vista, California, Fault Scarp (Abs.): Geol. Soc. of America Bull., Vol. 61, No. 12, Pt. 2, pp. 1529-1530.

Russell, R. J. (1926), Recent Horizontal Offsets Along the Hayward Fault: Journal of Geology, Vol. 34, pp. 507-511.

Sacramento Petroleum Association (1962), Main Prairie Gas Field, California: California Division of Mines and Geology, Bull. 181, Contribution 7, pp. 132-140.

Saul, R. B. (1973), Geology and Slope Stability of the S. W. 1/4 Walnut Creek Quadrangle, Contra Costa County, California: California Division of Mines and Geology Map Sheet 16.

Schnabel, Per B., and H. Bolton Seed, 1972, Accelerations in rock for earthquakes in the western United States, Report No. EERC 72-2, Earthquake Engineering Research Center, University of California, Berkeley.

Shlemon, R. J., Begg, E. L., and Carlton, A. B. (1973), Holocene Evolution of the Sacramento-San Joaquin Delta, California: Abstracts of Ninth Congress of the International Union for Quaternary Research, Christchurch, New Zealand, December 1973.

Sims, J. D., Fox, K. F., Jr., Bartown, J. A., and Helley, F. J. (1973), Preliminary Geologic Map of Solano County and Parts of Napa, Contra Costa, Marin, and Yolo Counties, California: U.S.G.S. Misc. Field Studies Map MF-481.

Storey, J. A., Wessels, V. E. and Wolfe, J. A. (1966), Radiocarbon Dating of Recent Sediments in San Francisco Bay: California Division of Mines and Geology, Mineral Information Service, March 1966, pp. 47-50.

Strand, Rudolph G., and Koenig, J. B. (1965), Geologic Map of California, Olaf P. Jenkins Edition, Sacramento Sheet: California Division of Mines and Geology, Scale 1:250,000.

Tocher, D. (1958), Earthquake Energy and Ground Breakage, Bulletin of the Seismological Society of America, Vol. 48, pp. 147-153, April.

Tocher, D. (1959), Seismic History of the San Francisco Bay Region: in California Division of Mines Special Report 57.

Tolman, C. F. (1931), Geology of Upper San Francisco Bay Region, Appendix D of Economic Aspects of a Salt Water Barrier Below Confluence of Sacramento and San Joaquin Rivers, California: Division of Water Resources Bull., 28.

Treasher, R. C. (1963), Geology of the Sedimentary Deposits in San Francisco Bay, California: Geol. Soc. of America Bull., Vol. 62, No. 9, pp. 1079-1110.

Trifunac, M. D. and Brady, A. G. (1975), On the Correlation of Peak Acceleration of Strong Ground Motion with Earthquake Magnitude Epicentral Distance and Site Conditions, Proceedings of the U. S. National Conference on Earthquake Engineering-1975, E. E. R. I., June 1975, Ann Arbor, Michigan.

Wallace, J. H., Phillips, H. C., Drake, R. M., and Boggs, E. M. (1907), Report of Committee on the Effect of the Earthquake on Railway Embankments, Proc., ASCE, Vol. 33.

Weaver, C. E. (1949), Geology and Mineral Deposits of an Area North of San Francisco Bay, California: California Division of Mines Bull. 149.

Wood, H. O., 1908, Distribution of Apparent Intensity in San Francisco, in The California Earthquake of April 18, 1906-Report of the California Earthquake Investigation Commission (A. C. Lawson, Chairman), Carnegie Institute of Washington.

Woodward-Clyde Consultants (1975a), Preliminary Surface Water Resource Evaluation-Dam Sites, Proposed Dow New Plant, Solano County, California: Report to Dow Chemical, May 28.

Woodward-Clyde Consultants (1975b), Geotechnical Investigation for Proposed Dow Dock Facility, Solano County, California: Report to Santa Fe Pomeroy, Inc., June 2.

Woodward-Clyde Consultants (1975c), Submittal of EIR Report Input, Geology, Soils, and Seismicity, Dow New Plants, Pittsburg and Solano Areas: Report to J. B. Gilbert & Associates, July 9.

Woodward-Lundgren & Associates (1974), Fault and Landslide Evaluation of Keller Ranch, Contra Costa County, California: Report to E. V. Schulhauser and Associates, February 6.

Pipelines XIII

CHAPTER XIII

PIPELINES

Commentors have requested more information on the impacts of the construction and operation of the four pipelines proposed to connect the Montezuma site with the expanded Pittsburg facilities. Actually, the project involves many miles of hydrocarbon pipelines connecting various process units. The risk associated with the operation of these facilities is the possibility of accidental spills. The following responses relate to the four steel pipelines proposed to extend across the Sacramento River, Sherman Island, and San Joaquin River.

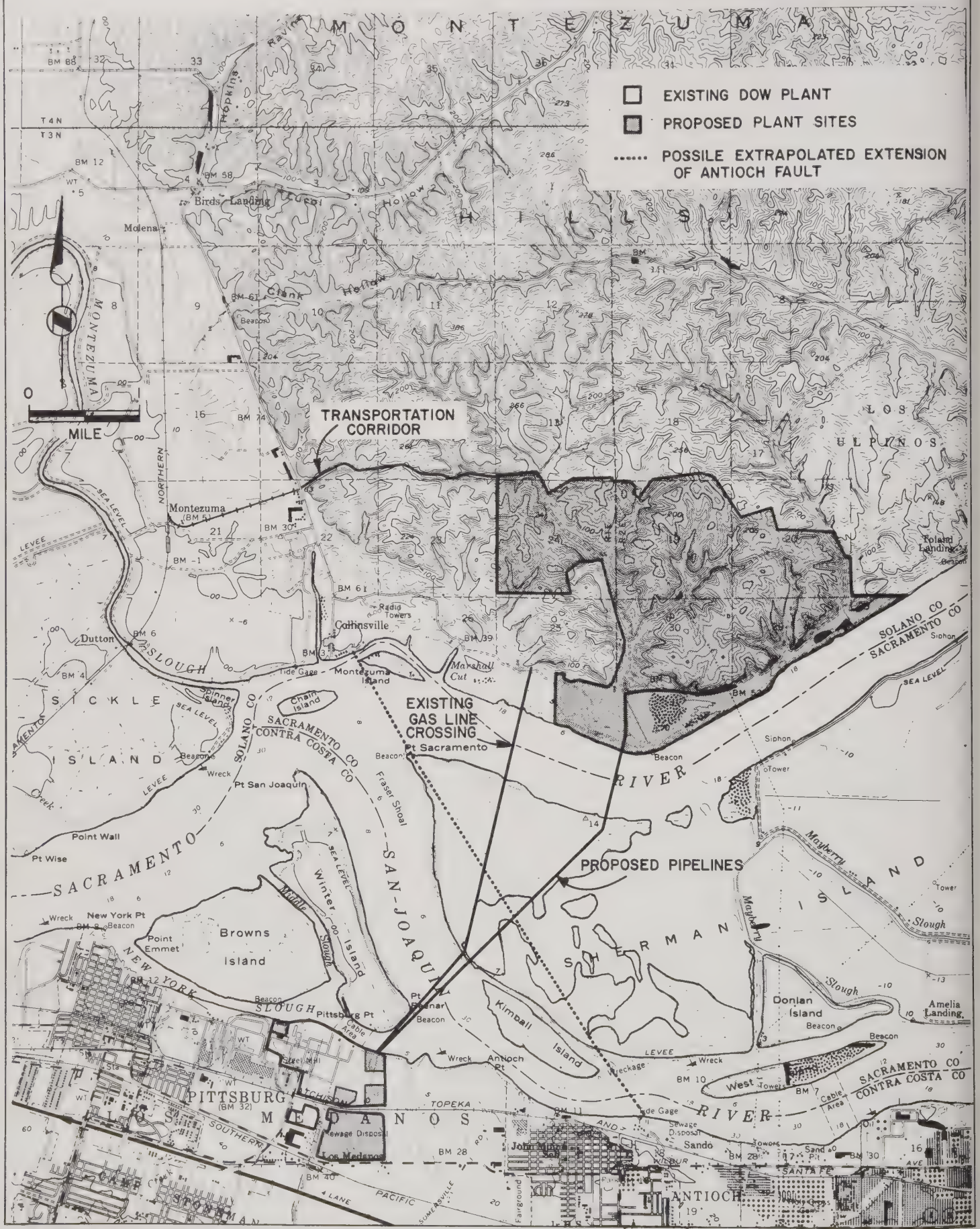
One pipeline would transfer ethylene from the Montezuma site to the Pittsburg site; similarly, another pipeline would transfer propylene. A third pipeline would transfer hydrogen from Pittsburg to Montezuma. The fourth line would function as a spare and would be used only during periods when the other lines are pressure checked or as maintenance operations are underway. These four pipelines are subject to permits by the US Army Corps of Engineers, the State Lands Commission, and The Reclamation Board.

PIPE CROSSING DETAILS

Pipeline construction is proposed to avoid marshland areas wherever possible (see Figure XIII-1). It has been suggested that the pipeline be located adjacent to the existing gas pipeline which crosses the western edge of Sherman Island. Following that route would result in 4,500 feet more of pipeline and hence additional area exposed to possible damage and result in a long crossing of the Sacramento River or a long pipeline paralleling the north shore of the Sacramento River necessitating easements and creating potential for future conflict with any proposed shoreline uses. The exact final alignment of the pipeline will be determined after review during the Corps of Engineers permit process.

The welded steel gas pipelines with a wall thickness of 0.307 inches are proposed to be spaced about two feet apart and occupy a horizontal dimension of 86 inches. At the two ship channel crossings, the pipelines would be placed in a backfilled trench 10 feet below the existing bottom or projected maintained channel

FIGURE XIII-1
TOPOGRAPHIC FEATURES OF PROJECT AREA



J.B. Gilbert & Associates - October 1975

bottom, whichever is deepest. In the marsh crossing area (Lower Sherman Island), the pipeline would be installed three feet below the surface. It is proposed to isolate the river crossing sections with automatic closing valves on the north and south edges of the crossing. These valves would be actuated in the event of a pressure drop.

The pipelines can be constructed within a narrow swath of land, thus disturbing a maximum width of approximately 40 feet in dry areas and 20 feet in underwater areas. As a result, it is expected that of the total 3,100 acres on Sherman Island, approximately 7 acres will be disturbed as a result of this construction.

WILDLIFE IMPACTS

Construction will cause direct impacts by destroying habitats along the pipeline routes. The wildlife habitat losses will be temporary until revegetation occurs along the pipeline route. Natural revegetation will take place within a two-year period. It is anticipated that the marsh-open water interface habitat will be the most severely disrupted. The habitat can be an important feeding and breeding area for many animal species.

Plants in the marsh consist of tules, sedges, and cattails almost exclusively. The levee and borders of the Island that are drier support a different plant and animal life (see Draft EIR page II-44). By constructing the pipeline away from this drier land, physical disruption of the habitat will be minimized; however, construction activities will disturb all animal life in the vicinity.

PIPELINE FAILURE

While a complete rupture of the three pipelines crossing the Delta is unlikely even under severe earthquake conditions, the impact of such a rupture should be postulated.

The pipelines are 18,500 feet in length and a maximum of 10 inches in diameter. Automatic valves, actuated by low pressure sensors, would close in the event of pipeline rupture. These valves would be located at each end of the underwater crossing. In the event of a rupture, the material in the pipeline between the automatic valves would be dissipated to the environment. An allowance of two minutes is made for the closure of the

automatic, "fail-safe" valves. An instrument signal would be transmitted instantaneously to the plant control room for immediate response in the plant by the operating personnel.

If the ethylene line ruptured, 18,000 pounds of ethylene gas would be released. Since ethylene is almost insoluble in water, the ethylene would rise to the surface in a violent, bubbling action. At the surface, the ethylene would be dispersed into the air and diluted depending on atmospheric conditions at the time of rupture. A flame front or explosion could result if an ignition source is present (e.g., a boat motor) and the concentration of ethylene in the air remains between 2.7 and 36 percent by volume. If wind conditions were very low (thus prohibiting dispersion) or if atmospheric inversion conditions exist, the ethylene could remain relatively trapped as a pocket for some time interval, since its density is about equal to that of air.

If the propylene line ruptured, about 119,000 pounds of propylene gas would be released. The results would be similar to that of ethylene and again, very dependent on the atmospheric conditions at the exact time of rupture. An ignition source would be necessary to cause a flame front or explosion. The range of propylene concentration which would permit an explosion is narrower than that for ethylene, being not less than 2.0 percent by volume nor more than 11.1 percent by volume. This narrower range reduces the risk; however, propylene is more dense than air and hence, would tend to remain longer in an entrapped pocket under adverse wind and inversion conditions.

If the hydrogen line ruptured, about 300 pounds of hydrogen gas would be released. Similar to ethylene and propylene, the hydrogen gas would bubble up through the water though with less violence due to a lower pressure in the hydrogen line. Hydrogen also could create a flame front or explosion at the surface when mixed with air. An ignition source would have to be present. Hydrogen has a wide range in which ignition can take place, being not less than 4.0 percent by volume nor more than 75 percent by volume. Hydrogen being the lightest gas known would rise through inversion conditions and disperse. Marine life would not be affected by pipeline failure. The products flowing in the plant piping system or process units when the pipeline fails are burned in the atmosphere in automatic flaring towers. These towers would be equipped with shielded pilot lights to provide automatic fail-safe operation. The maximum total potential for pipeline leakage of 140,000 pounds is equal to the capacity of an LPG rail car. It has been estimated that there are approximately 14,000 such rail cars in service in the United States.

MITIGATION MEASURES

Construction Impacts

Construction should take place during that season which assures that disturbance of wildlife breeding activities will be minimized. After construction, the pipeline route should be replanted with native species to assure a rapid return to favorable conditions for the wildlife. The actual construction activities should be confined to the most narrow possible corridor to minimize adverse impacts.

To create additional water surface in the Sherman Island marshes, the Department of Fish and Game requested that additional pothole habitats for waterfowl, fish, amphibians, and reptiles be provided by The Dow Chemical Company during construction of the four pipelines. Thus, the marshland would be maintained in a steady state as opposed to a gradual progression of filling and creating drier land. Although a temporary measure, the method is effective in the maintenance of a balanced, indigenous, wildlife community. The Dow Chemical Company has agreed to such a stipulation.

Pipeline Design

In addition to the automatic closing valves on the north edge of the Sacramento River and the south edge of the San Joaquin River, careful consideration should be given to the incorporation of additional shutoff valves at the north and south edges of Sherman Island to reduce the amount of emissions in the event of pipeline failure. Special earthquake-anticipating design should be used in the vicinity of the Antioch fault crossing described in Chapter XII. The design should anticipate lateral and vertical movement and be done in conjunction with the determination of automatic valve shutoff spacing. Attention should also be given to maintaining independent structural integrity of each individual pipeline.

Operations

In addition to continuous recording of individual pipeline pressures, regular trial operation of the automatic valves should be scheduled to assure continual operating readiness. Pipeline structural integrity should be assured by continuous cathodic

protection on individual pipelines and records maintained regarding the current requirements to determine coating integrity.

Utility Planning

Because of the likelihood of additional crossings of the Sacramento River and Delta area, consideration should be given by the Corps of Engineers to the establishment of a utility corridor which would result in common areas at various points along the River for pipeline crossings. Consideration should include possible adverse effects of locating pipelines in close proximity to others considering materials conveyed and advantages of avoiding numerous crossings and potential interference with construction or navigation activities.

Pipeline Failure Emergency Plan

A pipeline failure emergency plan should be prepared as part of the spill contingency plan recommended in that response. It should include reports monitoring for leaks, valve closure procedures, and a plan for evacuation of the immediate vicinity of cross-channel pipeline failure.

Accidental
Spills XIV

CHAPTER XIV

ACCIDENTAL SPILLS

Many comments were received on the Draft Environmental Impact Report relative to the issue of environmental effects of spills of hazardous materials occurring on land and water. The following discussion of spills should be considered in light of the proposed mitigation measures which call for studies and programs that should be completed before operations commence.

The purpose of this section is to analyze the possible impacts resulting from varieties of accidental spills that could occur from the proposed facilities. It should be emphasized that by definition, the impact from spills to date has been of very limited extent and duration. Although there have been recent oil spills in the San Francisco Bay Proper and small spills in some of the extended portions of the estuary that have resulted in economic and environmental damage, the impacts have not been catastrophic and have only been short-lived.

Current public policy regarding protection of water and natural resources, particularly in the Delta and Suisun Marsh areas as well as all of the San Francisco Bay estuarine system, requires that the utmost care be taken to minimize if not eliminate any possible opportunity for pollution, short- or long-term. Existing technology and capability is available to minimize the risk of spills as well as reduce the environmental impacts if a spill should occur.

As stated in Chapter I of the Draft EIR, the feedstocks would principally be transported by water movements. Annually, about 1.75 million tons of naphtha would be delivered to the Montezuma site either by barge from San Francisco Bay Area suppliers or by ship from Alaska, Washington, or Los Angeles. In addition, about 870,000 tons of salt (NaCl) would be barged to the Pittsburg site from the Bay Area suppliers.

The major product shipment by water would be caustic soda and would be shipped from Pittsburg to Pacific ports--primarily West Coast. Some might also be shipped by rail or truck to smaller customers or those without port facilities. Styrene

would also be shipped by water from the Montezuma site to fabricating plants now located in the greater Los Angeles area and possibly to foreign ports. Some styrene might also be shipped in rail tank cars to other users on the West Coast.

All other products would be shipped from the Montezuma site by rail tank car and from the Pittsburg site by rail tank car, rail hopper car, or truck. A summary of estimated product and raw material shipments is presented in Table XIV-1.

This section describes the major products that will be transported, the risk of spills, and the resulting effects of those products on the environment if a spill should occur.

PROBABILITY OF ACCIDENTS

The probability of accidents as determined by accident frequency rates will vary with the mode of transport, safety precautions employed, and type of product, its handling, and a wide variety of other factors. The liklihood of spills as a result of an accident has an even smaller probability associated with such an event. The following paragraphs discuss the probability of accidents associated with movement of the various raw materials and products related to the proposed Dow project.

Trucking Accidents

The probability of a trucking accident is in the range of 10^{-6} to 10^{-8} per vehicle mile travelled. Fatality rates for the trucking industry are approximately 2 fatalities per 100 million miles travelled (Motor Vehicle Manufacturers Association, 1974). This is compared to fatalities per 100 million miles driven for passenger cars (National Safety Council, 1975).

An estimated 13,000 trucks carrying various products will be leaving the Pittsburg facility each year. These include tank trucks and hopper trucks which will be delivering material within the greater San Francisco Bay area. Assuming an average trip of 50 miles one way, this will amount to an average of 0,168 million miles travelled. With a probability of one-in-a-million (10^{-6}) for an accident serious enough to cause a fatality and possibly a spill, there is a probable chance of an accident involving a truck carrying a Dow product on the magnitude of once every 18 months.

TABLE XIV-1

SUMMARY OF ANTICIPATED PRODUCT
AND RAW MATERIAL SHIPMENTS

Mode of Transportation	Materials	Annual Movements	Approximate Daily Average
To Montezuma			
Ships	Naphtha	97	--
To Pittsburg			
Barges	Salt	87	--
From Montezuma			
Tank Cars	Styrene, Phenol and Acetone	1,825	10*
Barges	Styrene, Unsaturated isomers of pentane and butance	71	--
From Pittsburg			
Tank Trucks	Caustic, propylene oxide, chloroethylenes	5,950	16
Hopper Trucks	Polyethylene	7,600	21
Tank Cars	Caustic, propylene oxide, chloroethylenes	1,525	10*
Hoppers	Polyethylene	3,077	20*
Barges	Caustic	31	--

Source: Stanford Research Institute, 1975

*Every second day.

Railroad Accidents

The national accident rate has been estimated to be approximately 0.8 accidents per million rail car-miles (U. S. Atomic Energy Commission, 1972).

An estimated 4,900 rail cars will be used each year in transporting various products from the proposed facilities. Assuming that each railcar travels an average distance of 500 miles, the likelihood of an accident involving a rail car carrying a Dow product is about one incident every six months. The likelihood of such an accident resulting in a spill has a smaller probability associated with each incident.

Shipping Accidents

Data on the frequency of accidents involving ships and barges in San Francisco Bay-Delta area is presently not reported in a form which makes it suitable for deriving an accident frequency rate (U. S. Army Corps of Engineers and U. S. Coast Guard, personnel communication, October 1975). As part of the spill analysis discussed in the mitigation measures at the end of this Chapter, the probability of the likelihood of shipping accidents should be developed.

RAW MATERIALS

Naphtha, with the fluidity of kerosene, is a nondefined mixture of chemicals found in crude oil. It is obtained by the fractional distillation of crude oil and it contains distillates with low, medium, and high boiling points, molecular weights, and chemical complexity. The carbon numbers of the components in the naphtha may range from C_2 to C_{20} with the greatest percentage, about 70 percent, less than C_8. However, the concentration of the components will vary from one naphtha to another depending upon the crude oil source or the actual naphtha produced by fractional distillation.

Since the naphtha source for the proposed Dow petrochemical facilities could be from any of the West Coast refineries which may refine crude oil from Alaska, Texas, Los Angeles, Santa Barbara, the Carribean, or even the Middle East, it is not possible to predict the actual concentrations of the various components in the Dow raw material.

PHYSICAL PROPERTIES OF CHEMICALS

Hydrocarbons less than C_4 have low partial pressures, low boiling points, and evaporate quickly in natural air. Whereas straight chain hydrocarbons from C_5 to C_8 will evaporate slowly and are soluble in water. The aromatic hydrocarbons (i.e., benezene compounds) are variable in regard to water solubility; however, solubilities vary with temperature and pH of the water. A summary of physical constants of materials to be handled at the proposed Dow facilities is shown in Table XIV-2.

TABLE XIV-2

PHYSICAL CONSTANTS OF
CHEMICALS TO BE HANDLED

	Boiling Point °C	Specific Gravity	Solubility mg/l
Acetone	56.6	.792	Infinite
Benzene	80	.879	820
Butadiene (inhibited)			insoluble
Butane	.6	.6	slightly insoluble
Caustic soda (NaOH)	1,390	2.13	420,000
Chlorine	34.6	3.2	--
Cumene	152	.86	27,000
Ethyl benzene	136	.86	insoluble
Ethylene	-103	.001	300
Pentane	36	.62	360
Phenol	182	1.07	Infinite
Polyethylenes			
Propylene	-47	.002	880
Propylene oxide	35	.8	650,000
Sodium chloride (NaCl)	1,413	2.16	357,000
Styrene (monomer)	146	.9	very slightly
Vinyl chloride	-13.9	.9	slightly soluble

Source: Dawson, 1970

TOXICITY OF CHEMICALS

The majority of hydrocarbon pollution investigations relate to spills of crude oil, diesel oil, and bunker "C" fuel. Although opinions lack unanimity of the effects of crude or distillates on the biotic community, the consensus opinion is that aromatic derivatives are toxic at low concentrations. Critical concentrations of products that will be handled at the new Dow facilities are shown in Table XIV-3.

TABLE XIV-3

CRITICAL CONCENTRATIONS

	Aesthetic Critical Concentration mg/l	Fish Toxicity mg/l	Plant Toxicity mg/l	Field Detection Limit mg/l
Acetone	40	13,000	--	200
Benzene	.5	5	--	.5
Butadiene (inhibited)	--	71.5	--	10
Butane	--	710,000	--	10
Caustic soda (NaOH)	--	20	50	.2
Chlorine	.5	.03	100	.1
Cumene	--	1-100	--	--
Ethyl benzene	--	50	--	100
Ethylene	--	22	--	10
Pentane	--	100	--	10
Phenol	.001	.1	--	.001
Propylene	--	1,000-10,000	--	1,000
Propylene oxide	--	1,000-10,000	--	100
Sodium Chloride (NaCl)	500	2,500	700	1
Styrene (monomer)	.1	25	--	1,000

Source: Dawson, 1970

The lack of data on the toxic effects of naphtha, components, or derivatives prevent a direct assessment of the effects of spills on the marshes and Delta. However, using data which are available for the effects of crude oil, diesel oils, and bunker "C" fuel on aquatic organisms, some projections can be made.

The work of Zobell (1962) indicates that toxicity of these fuels and crude oil increases as the aromatics and soluble hydrocarbons increase. Also, an emulsion of oil will have a greater detrimental effect on submerged organisms. Water soluble fractions will narcotize oysters and taint their flesh at very low concentrations.

The toxicities of the hydrocarbons $\geq C_5$ can increase directly with solubility because the hydrocarbons can contact more living organisms. In solution, the substances can affect benthic, pelagic, attached, and littoral organisms while the heavier, insoluble substances will effect the littoral area.

Although soluble in water, hydrocarbons $< C_4$ probably would not remain in solution very long because of their low partial pressures. No evidence for toxicity in water has been found for these materials.

Briefly, hydrocarbons are toxic to wildlife and any spill, chronic or catastrophic, can be expected to have adverse effects on plants and animals coming in contact with the material. The effect will depend upon several factors:

- The ability for the species to escape the area.
- The natural resistence of the species to the chemical.
- The concentration of the chemical.
- The solubility of the chemical.
- The toxicity of the chemical.
- Duration of contact.

Sublethal Effects

Chronic or long-lasting spills have effects that, although not lethal, could cause metabolic and behavior changes that are detrimental to survival. For instance, intertidal organisms may be unable to reattach or settle on a suitable substrate; worms and crabs may leave protected (confined) areas and be subject to greater predation. Filter-feeding animals may be unable to feed; apical meristems of plants can be damaged or destroyed; and crustaceans may loose limbs affecting the ability to seek and capture food.

SPILLS OF PETROLEUM AND HAZARDOUS MATERIALS

Over 13,000 spills of oil and hazardous substances occur annually in the United States. Over half of these are small and involve less than 100 gallons. Hazardous substances including oil and chemicals annually are responsible for killing thousands of fish and birds. In addition, hazardous substances spilled into the aquatic environment can cause subtle long-term changes.

They can interfere with vital processes such as photosynthesis and induce changes in aquatic organisms. For example, fish may lose their ability to secure food, avoid injury, escape from enemies, choose a habitat, recognize territory, migrate, communicate, and reproduce.

Spills of hazardous chemicals, although not as frequent as oil spills are extremely significant in terms of their immediate and long-term effects on the environment and the threat they pose to human, plant, and animal life. This is particularly amplified in areas adjacent to or tributary to major waterways or marsh areas. A spill resulting from a rail or truck accident adjacent to the Suisun Marsh would have significant short-term and long-term effects on the Marsh and the numerous species that reside, feed, or nest in the Marsh and adjoining upland areas.

Spill Prevention Programs

Responsibility for the Federal Oil and Hazardous Substances Spill Prevention Program is divided between the Environmental Protection Agency and the Coast Guard. EPA is responsible for both onshore and offshore facilities within the three-mile limit of territorial seas which are not related to transportation. This would include facilities such as the existing and proposed Dow Chemical facilities. The Coast Guard is responsible for marine transportation-related facilities such as vessels, docks, pipelines, etc. Authority includes operation and maintenance inspections, clean-up, and civil penalties for violation of statutory provisions.

Federal Regulations (40 CFS, Part 112) require a Spill Prevention, Control, and Countermeasure (SPCC) Plan be prepared and implemented in all large facilities such as the proposed plants.

Most hazardous substances are soluble in water and are not readily removed once they are released into the aquatic environment. Prevention of spills is thus of utmost concern.

Hazardous substances spilled are subject to civil penalties under the provisions of Section 311 (b)(2) of the Federal Water Pollution Control Act Amendments of 1972. Fines are assessed taking into consideration the mitigation measures and precautions taken by the spiller.

The State of California also has numerous regulations regarding the handling and disposal of oil and hazardous materials. In the event of spills resulting from accidents or natural disasters, various State agencies coordinate their efforts to minimize any threat to human or animal life, property, and the environment.

In preparing for such occurrences The Resources Agency has developed an "Oil and Hazardous Materials Contingency Plan" which delineates procedures to follow and responsibilities of the various State and local agencies.

Dow is responsible for preparing a Spill Prevention, Control and Countermeasure Plan which will be made available to all applicable Federal, State, County, City, and local agencies as well as plant operating personnel, waste hauling, and product transporters.

Transportation of Products and the Potential for Spills

Railroad Tank Cars. Railroad tank cars move the greatest volume of bulk liquids, and the U. S. Department of Transportation has classified approximately 75 types of cars for carrying over 1,000 different commodities.

Examples of the products transported in the type of car and its classification are illustrated below:

Products	Type Car	Classification
Anhydrous ammonia Ethylene oxide Liquid chlorine Propane Propylene oxide Vinyl chloride	Pressure steel	DOT 105A 300W 105A 300W 105A 500W 105A 300W 105A 100W 105A 300W
Glycols	Nonpressure alumium	DOT 111A 60 ALW
Aqua ammonia Caustic soda solution Chlorinated solvents Ethyl benzene Glycols Phenols Polyglycols Petroleum products Heavy fuel oils	Nonpressure steel	DOT 103 W

Railroad cars are designed to cope with liquid properties such as corrosives, toxicity, and vapor pressure. Design features include high or low pressure safety valves, safety vents with rupture disks, multisectional units with broad temperature and pressure controls, and a variety of loading and unloading features.

Derailment represents the major potential for railroad spills. Good inspection of roadbeds, rails, and equipment can minimize the derailment potential. Other spills or leaks can also occur by unforseen circumstances and during loading or unloading at terminals through carelessness or equipment and valve failures.

Bulk Tank Truck Trailers. Tank trucks provide for serving a broad range of services and door-to-door service from producer to customer. Normal loads range from 2,600-8,500 gallons. Tank trailers are constructed in a wide variety of sizes and incorporate various installation, pressure, and auxilliary support systems. They offer the same potential for spills as tank railroad cars except they operate under less isolated conditions and have a greater chance of becoming involved in an accident on a road or freeway.

Bulk Barge Shipment. Of the 17,000 barges in the United States there are approximately 2,600 tank barges operating. There are three general types of tank barges single skin, double skin, and independent tank. Besides collision and sinking, spills can occur during loading and unloading or bilge disposal. Bilge material should be pumped out and treated and disposed along with other liquid wastes.

Spills From Onshore Storage. Causes of spills which are common to all storage facilities include human error, equipment failure, and natural disaster or sabotage. Proper design and conformance to established safety requirements can minimize leaks and spills which could impair water quality.

General Effects on the Aquatic Environment

A spill, either accidental or deliberate, could occur during ship or barge transit through the Bay to the site on the Sacramento River. The extent of the spills' effect depends upon location, size of spill, material spilled, and river conditions.

Petroleum fractions, when spilled or in some other manner reach the aquatic environment, could have a variety of effects of aquatic animals and plants. It also could damage property (e.g., boats, piers) or present a fire hazard. Aesthetics are also important as the visibility of oil varies with the quantity and area over which it spreads. Table XIV-4 quantifies the amount of oil which will cause a visible effect noticeable to humans under ideal surface conditions with little wave action or chop.

TABLE XIV-4

VISIBLE EFFECTS OF OIL SLICKS ON WATER

Visible Effects	Thickness microns*	Quantity gallons/mile^2
Barely visible	.038	25
Silvery sheen	.176	50
Trace of color	.152	100
Bright bands of color	.305	200
Colors dull	1.016	666
Colors dark	2.032	1,332

*One micron = 4 x 10^{-6} inches

As can be seen from the data in Table XIV-4, even a very small quantity of oil could produce a noticeable effect in local waters.

Generally, all the spilled material has some soluble components which will spread the contaminant through the water column. The levee system along the River, Sherman Island, Montezuma Slough, and Suisun Marsh does afford some protection of the island areas. However, migrating and resident fish could be killed or habitats and breeding disrupted. Plankton as well as rooted and floating vegetation could be destroyed or growth severely limited.

One problematic effect would be the possibility of light fractions or derivatives to enter and move through the soil column which could present chronic, sublethal effects on burrowing forms and plant roots. Once in the soil profile, the chemicals would resist breakdown by autoxidation, bacteria, sunlight, and temperature. The presence of the chemicals could alter soil pH, oxygen present, soil composition, and thereby effect the plants and the marsh community.

Effects of Petroleum Products on Waterfowl

Petroleum products and petrochemicals include a wide variety of compounds many of which are toxic to waterfowl and other aquatic life.

In the event of an accidental spill or natural disaster, some of these compounds may contaminate local surface waters and pose a threat to waterfowl in the area. If such an event ever took place, the type of birds involved will influence the management methods used in clean-up.

The major factor which causes death in most birds involved in petroleum spills is ingestion of toxic substances during preening of coated feathers.

The capture, handling, and clean-up of birds involved in spills is highly varied. From studies done to date (Griner & Herdman, 1970) it appears that birds which are both terrestrial and aquatic (such as ducks and geese) can be handled and cared for more readily than more aquatic species (grebs, loons, etc.). Diet and feeding habits plays an important role in care since nutrition and loss of body heat are crucial to survival of petroleum or chemical-coated birds. Fish-eating birds are harder to care for than herbivorous or omnivorous species. Also, the stress the birds get from handling and the toxic nature of many cleaning compounds can result in death of birds that might otherwise recover.

Effect of Hazardous Materials on Aquatic Life

Phenol, chlorine, and various acids and alkalies pose the greatest hazard to fish as a result of accidental release of chemicals to the aquatic environment. Phenol is perhaps the most toxic compound with respect to aquatic life. A truck or rail accident adjacent to a drainage area tributary to Suisun Marsh could have severe consequences on this important fish nursery area. Species which reside in the Suisun Marsh as juveniles include the striped bass and Delta smelt and the native anadromous squawfish, splittail, Sacramento sucker, Tule perch, and Sacramento blackfish. Exotic fishes which are residents include the Carp, White catfish, Black crappie, and Threadfin shad.

Phenol in irrigation water is not considered to be deleterious to crops and appreciable amounts of phenol (up to 5,000 mg/l) are not toxic to large mammals. However, phenols are toxic to algae, aquatic invertebrates, and fish.

Movement of Spilled Materials

Conomos (1971 and 1974) conducted surveys of current patterns in San Francisco Bay and Delta. By using surface and near-bottom drifters and confirming actual data from the 1971 oil spill from the Standard Oil tankers, seasonal current patterns were predicted. The 1971 tests indicate that:

- Density-induced advective flow, caused by the Sacramento-San Joaquin outflows occurs year-round.
- A permanent westward drift occurs from Rio Vista for both the near-bottom and surface waters.
- There is a landward transport of submerged contaminants by estuarine circulation.
- Near-bottom waters move westward at about 4 km per day.

Based on those studies, the drift of the bottom and surface currents would place any spilled materials from the Montezuma dock area into the Sherman Island marshes.

Any soluble materials would follow the drift of both surface and bottom currents whereas floating materials would follow only the surface currents. Currents from the Rio Vista and Antioch areas would carry most pollutants into Suisun and San Pablo Bays. However, at 4 km per day, it is unlikely that the pollutants would cause damage in San Pablo Bay because of dilution break-down and volatilization that would undoubtedly occur. The primary danger would be to the Suisun and Sherman Island Marshes.

It is difficult to make accurate judgments on the movement of waters. River runoff, tides, and wind are major factors that contribute to observable net movements of water in an estuary. River runoff creates density-induced circulation; wind causes major fluctuations in surface water flows; and tides increase the mixing rate and contributes to net water movements.

Estuarine Effects

Oil spill effects have been studied in relation to a few estuaries; however, the toxicity was grouped as an effect of the spill rather than by individual components. Therefore, much

work remains to be done before accurate predictions can be made for estuaries. The most difficult aspect to predict is the effect of tides, river flow, and winds.

The Oakland Harbor crankcase oil spill that occurred in January 1973 caused much damage to homes, boats, and other facilities. Waterfowl were coated by the oil while plankton, plants, and other mudflat organisms were killed. Many clams and some crabs were also reported killed, but no fish were known to have died as a result of the spill. Although, it cost in excess of $1,200,000 to clean up the spill, the area did recover.

Growth of these marsh plants is affected by crude oil at concentrations of only 25 ml per square foot: Saltgrass (Distichlis spica), salt wort (Bastis, sp) glass wort (Salicornia bigelovii), Cordgrass (Spartina alternifolia), young Mangroves (Avicenna, sp), and several other emergent plants. Although it is difficult to separate the effects of specific causative agents, the chronic pollution by crude, distillates, or derivatives have a growth-inhibiting effect on organisms. (This is the basis for anti-fouling compounds for boats, piers, and sea walls.) Evidence is available which indicates that persistent oil compounds can inhibit growth of marsh plants (see Table XIV-5).

Shipping accidents with a resultant spill of toxic materials could have serious repercussions with respect to Bay Area fisheries. Oily materials that float, although toxic, are not as great a threat to pelagic forms because they can swim away. However, the soluble fractions of naphtha or its derivatives could have a significant adverse effect by direct toxicity to the adult or larval fish, sperm and ova, food such as Neomysis mercedis, and tainting of the fish making them unpalatable. The degree of the effect would depend upon the concentration of the chemical in the water, duration of contact, and toxicity to different species.

TABLE XIV-5

EFFECTS OF CRUDE OIL ON MARSH PLANTS

	Amount of Oil Applied Per Pen				
	None	187 ml	375 ml	750 ml	1,500 ml
Calculated amount of oil per acre (U. S. gallons)*	0	134	269	539	1,078
Time oil remained visible on water surface (days)	--	30	30	60	60
Time oil persisted in bottom mud (days)	--	60	60	100	180
Plants surviving in pen after 2 months (percent)	100	100	90	85	75
Plants surviving in pen after one year (percent)	100	100	90	50	10

*42.5 gallons = 1 barrel of crude oil

Source: Zobell , 1962

Sherman Island

Sherman Island presents a special problem with respect to spills since it has a long exposed shoreline influenced primarily by tidal action. River currents probably eddy and would tend to force spilled contaminants into the marshland itself. All animals and plants in contact with the contaminants would be affected; but the effect depends upon resistance, dilution, and chemical form of the contaminant. It would be extremely difficult to remove the oily contaminants once they enter the tule islands.

Sacramento-San Joaquin Delta

Since the Delta is a nursery area for striped bass, it could be adversely affected by a petroleum spill. The primary food source for the resident and migratory fish is Neomysis mercedis which could be killed in large numbers. Neomysis live in the

Delta at or near its critical life requirements (temperature and salinity). Therefore, a spill causing a reduction in the Neomysis population could also adversely affect the striped bass fishery.

Suisun Marsh and Montezuma Slough

The greatest damage to aquatic life would occur in the Slough, along the levees of the Slough and Marsh, and in the unleveed portions of the Marsh. Soluble components of naphtha and products that might enter the surface soil regime could pervade to other parts of the Marsh and persist in its waters resulting in chronic or long-lasting sublethal effects.

Data are lacking for flow direction, volume, and time of travel through the Slough and Marsh. Also lacking is information on toxic effects of the specific constituents on indigenous animals and plants. Without this information, accurate predictions cannot be made; however, based upon available data (see Draft EIR for species list, river flows, and this section for toxicities) soluble and floating fractions could cause extensive damage in Montezuma Slough and Suisun Marsh.

Spills on Land

As previously stated, several products would be shipped by rail and truck. These include: acetone, phenol, caustic, polyethylene, propylene oxide, styrene, and chloroethylenes. Although a major spill at any location would be a serious problem, this discussion will be limited to spills on the sites or near Suisun Marsh.

Minor spills will undoubtedly occur at the tank car and tank truck loading areas. However, proper safety precautions, such as explained in the reprint from "Chemical Engineering" entitled "preventing and Dealing with In-Plant Hazardous Spills" and which is included at the end of this section, should minimize the dangers and impact.

Trucking and rail accidents would cause severe impacts where the materials contact living organisms. The immediate impact and severity will depend upon resistance of the species and duration of contact. Other effects would involve movements through the soil to groundwater. The effects would depend upon

degradation of the substance during the portage through the soils or groundwater. In anaerobic areas, the degradation would be expected to be minimal.

A recent railroad accident near Cordelia discharged the contents of a tender, about 4,000 gallons of diesel fuel, into Cordelia Slough. Although the diesel fuel was contained in the Slough as much as possible, , some entered the Marsh through pumps along the levee. The damage to frogs, crayfish, and waterfowl was extensive but not completely quantified because so much of the fuel entered the tules a proper assessment could not be made.

Chronic Spills

Several types of small chronic spills could occur at the dock as well as the truck and rail loading areas. These include the discharge of ballast or bilge water, connection hose leaks, deck washing, and other minor incidents. These spills should not create an extensive problem but rather a localized one. However, existing Dow safety procedures and equipment have and can prevent this type of spill.

DOW PITTSBURG CONTINGENCY PLAN

The Dow Chemical Company has a plan for dealing with spills at its existing Pittsburg faciltiies (see the reprint of "Chemical Engineering" article at the end of this chapter). The existing plan includes the following features:

Existing Accident Spill Plan - Process Facilities

1. Spill containment - Spill containment at Pittsburg is achieved in slab, dike, and rundown basins at each chemical production, handling, and storage facility. Storm drainage is continuously monitored for pH, turbidity, and total oxygen demand. An automatic diversion gate is activated if storm waters exceed set limits on these factors. Diverted material can then be treated or recycled as required depending on concentration and type of material which has been spilled.

2. Operations - The spill plan is separated into small units comprised of a single operating or production unit. Each of these unit plans consist of seven parts:

   a. A list of individuals to be contacted in the event of a spill. These include, in order, those individuals most knowledgeable with detailed operation of that operating unit.

   b. A process flow sheet which is a schematic drawing of plant processes showing the flow of materials from one piece of equipment to another.

   c. A detailed site map showing the location of each piece of equipment in the area of responsibility, its relation to other pieces of equipment, its size, and the material contained therein.

   d. Chemical Effects list, which is an investigation of the materials contained within the boundaries covered by the spill plan. It details important environmental, physical, chemical, biological, and toxicological properties of all materials.

   e. A monitoring check list that details the monitoring capacity of that handling unit toward detection of a potential spill from any possible source. This would be an indication of the first sensing that a spill has occurred either by instrument, personal observation, or calculation.

   f. This consists of containment alternatives that indicate the possibilities for containment for any spill from any piece of equipment within the operating unit. A series of containment alternatives are checked in probable order of use priority.

   g. A matrix of deposition alternatives in which equipment is listed as to probable use priority. An example would be transfer of spill material into another holding vessel, reprocess through other equipment, transfer into tank car or tank truck, transfer into drums, transfer to waste pond, transfer to shock pond, various treatment alternatives associated to each of these and other actions.

This plan presents alternatives needed for an adequate response to spills but there is no substitute for detailed knowledge of processes and materials that exist within a specified unit.

Case Analysis

If a spill should occur, the plan provides for a detailed review by division management to learn how the spill might have been prevented and how response might be improved in the future.

Transportation Emergency Spill Plan

All materials shipped from Dow facilities are transported in a manner designed to minimize any risk to transporting personnel and public safety. Equipment and vehicles used in transporting materials are labeled with a toll-free telephone number, 800-424-9300, to be dialed in the event of accident. This number reaches the CHEMTRECK offices which were established to supply industrywide service to all chemical handlers. Information is provided on the countermeasures to be taken and the nearest participating members of the emergency clean-up crews are notified. This industrywide participation program has proven very effective in minimizing response time to the scene of accidents or other spill occurrences.

Dow has its own company program to supplement the CHEMTRECK program. All transporters are supplied a hazardous chemical information card for the materials they are transporting on what to do, who to call, and what is required to avoid injury and provide for safe shipment of the products.

The amount of ship traffic currently arriving at the Dow Pittsburg facility is quite limited--averaging about 10 ships per year. These 10 ships, however, transport such hazardous materials as styrene, chlorinated solvents, glycols, acetone, chloropropenes, and versene products. No spills have been experienced as a result of Dow ship traffic. However, despite this limited risk potential and in anticipation of the need for a comprehensive program associated with the expanded facilities, the Dow Chemical Company has been negotiating with Clean Bay, Incorporated, to extend that company's capability in assisting Dow in the event of a spill. Clean Bay, Incorporated, is a non-profit corporation organized by oil companies and headquartered in Concord, California.

Clean Bay, Incorporated was established in 1971 to provide a commonly available emergency reaction capability in the event of oil spills anywhere in the Bay Area. It has a staff of 10 people who can call on an additional 500 other trained people in the event a spill should occur in the Bay Area. The company possesses approximately $2 million worth of clean-up and containment equipment as well as a well developed emergency response plan.

Current discussions between Clean Bay and Dow are designed to integrate Dow's response capability with that of Clean Bay, Incorporated.

MITIGATION MEASURES

An analysis of the probability of hazardous material transport should be made as part of the Spill Contingency Plan. Methods for this analysis are available and described in a paper entitled "Decision Analysis in Hazardous Material Transportation" written by A. S. Kalelkar, L. J. Patridge, and R. E. Brooks, Jr., and presented at a Joint Conference on Hazardous Substances held in San Francisco in September of 1974.

1. The Dow Chemical Company should develop a coordinated spill response plan with other industries with particular emphasis on on-site accidental spills.

2. The proposed Dow facilities and the potential for other similar facilities in the area make it essential that a detailed accidental spill response plan be developed. That plan would include an evaluation of accidental spill risk, classes of spills, detailed water quality and resource studies to determine the impacts of various types of spills of various materials, development of a response strategy, and finally an implementation plan.

A plan containing some of this information is required by the California Regional Water Quality Control Board, Central Valley Region by December 26, 1975, as part of its NPDES permit. It must include:

- Identification of the possible sources of accidental loss, untreated waste bypass, and contaminated drainage. Loading and storage areas, power outage, waste treatment unit outage, and failure of process equipment, tanks, and pipes should be considered.

- Evaluation of the effectiveness of present facilities and procedures and a statement as to when they became operational.

- Description of facilities and procedures needed for effective preventive and contingency plans.

- Prediction of the effectiveness of the proposed facilities and procedures. In addition, an implementation schedule containing interim and final dates when they will be constructed, implemented, or operational must be included. (Reference: Sections 13267(b) and 13268, California Water Code.)

After review of the technical report, the Regional Board may establish additional conditions which may be made part of the NPDES permit that was issued on September 26, 1975.

The spill response plan should be of similar detail as Standard Oil Company of California's Estero Bay Deep Water Terminal and Crude Oil Pipeline Project which was published in November 1973 as Appendix T to the Draft Environmental Impact Report for that project. That oil spill response plan included the following major items:

1. General Policy
2. Emergency Organization
   a. Structure
   b. Job Description
   c. Mobilization
3. Terminal Spill Response
   a. General
   b. Offshore Spills
   c. Onshore Spills
4. Pipeline Spill Response
   a. Leak Detection
   b. Precautions
   c. Emergency Operations
5. Spill Clean-up Resources
6. Special Services
7. Government Agencies
   a. Federal Requirements for Reporting Oil Spills
   b. State Requirements for Reporting Oil Spills
8. Consultants

Consideration should be given to the use of the USCE Bay-Delta model in predicting possible physical damage resulting from spills varying conditions. This could aid in the predictive part of the report which would include analysis of the type of spills (chronic, minor, or catastrophic), condition (floodtide, ebbtide, high-river, and low-river flows), area (Sacramento-San Joaquin Delta, Sherman Island, Suisun Marsh, Montezuma Slough, and downstream Bay zones), and toxicity to indigenous plants of the various products to be shipped. These in turn would be analyzed by source such as tanker, manifolds or attachment points, storage compartments, pipelines by location, terminal facilities, and spills from auxilliary equipment. Collisions between ships, estimates of damage, and possible losses of both cargos should also be included.

The ultimate product would be a contingency plan which identifies men and equipment to be deployed based on predetermined patterns of impact resulting from both water and land-based spills.

REFERENCES

Bennett, G. F. Ed. "Water 1972" American Institute of Chemical Engineers Symposium Series 129, Volume 69, 1972.

California Administrative Code, Division 4, Title 22, Chapter 2.

California Department of Transportation, California Transportation Statistics, 1973, CALTRANS, 1974.

Conomos. T. J. "Movement of Spilled Oil in San Francisco Bay as Predicted by Estuarine Nontidal Drift" in U. S. Department of Commerce, 1974.

Dawson, G. W., et al. "Control of Spillage of Hazardous Polluting Substances" Battelle Memorial Institure, Seattle, Washington, prepared for Federal Water Quality Administration, 1970.

Engineering Science, Inc. "Preliminary Investigational Requirements - Petrochemical and Refinery Waste Treatment Facilities" prepared for the Environmental Protection Agency, Project 12020EID, March 1971.

Griner, L. A. and Herdman, R. "Effects of Oil Pollution on Waterfowl - A Study of Salvage Methods", Environmental Protection Agency Research Grant 14-12-574, December 1970.

Keith, V. F. and Porricelli, J. D. An Analysis of Oil Outfalls Due to Tanker Accidents, U. S. Coast Guard, 1973.

Malina, Joseph F. Jr. "Toxicity of Petrochemicals in the Aquatic Environmental" Water and Sewage Works, pp. 456-460, October 1964.

McKee, J. E., and Wolf, H. W. "Water Quality Criteria", State Water Resources Control Board Publication 3A, 1971.

Motor Vehicle Manufacturers Association Motor Truck Facts, 1974.

National Safety Council Accident Facts, 1974.

Pessah, E., et al. "Preliminary Report on the Acute Toxicity of Canadian Petroleum Refinery Effluents to Fish" Canadian Fisheries Research Board, Technical Report No. 408, 1973.

State of California, The Resources Agency. "Oil and Hazardous Materials Contingency Plan", revised July 1974.

U. S. Army Corps of Engineers. "Waterborne Commerce of the United States, Calendar Year 1973", Waterways and Harbors of the Pacific Coast, Alaska, and Hawaii, Part 4, 1974.

U. S. Atomic Energy Commission, Environmental Survey of the Nuclear Fuel Cycle, November 1972.

U. S. Department of Commerce. Marine Pollution Monitoring (Petroleum), National Bureau of Standards Publication 409, December 1974.

U. S. Environmental Protection Agency. "Oil Spills and Spills of Other Hazardous Substances", March 1975.

U. S. Department of Transportation, Annual Report to Congress, 1973, National Transportation Safety Board, 1974.

U. S. Department of Transportation, California Transportation Statistics, 1973, CALTRANS 1974.

a reprint from

Chemical Engineering

A McGraw-Hill Publication/Published every other Monday

Preventing and dealing with in-plant hazardous spills

Preventing and dealing with in-plant hazardous spills

Chemical-spill-handling plans should provide information on alternate actions, results and risks in responding to chemical-spill situations.

George F. Wirth, Dow Chemical U.S.A.

☐ Most major chemical-manufacturing plants have safe-operation and materials-handling manuals, disaster plans, and many other manuals and documents of instruction for upsets of normal operating procedures. What else could be needed? Could it be another manual of instructions to deal with chemical-plant spills?

The answer to this question is yes, when an environmental agency makes a request for a spill-handling plan as part of an air- or water-discharge permit. Existing instructions do not seem to fulfill the requirement for specifying actions during a chemical spill.

The environmental agency wants to know what can be spilled, what the hazards of the spill might be, how the spill will be disposed of, what the plant has provided for protection against the occurrence of spills, and what the impact of the spill is beyond the plant environment. The inability of plant management to provide quick and ready answers to these questions is conclusive evidence to the agency—as well as to the public—that such management is not capable of preventing spill damage to persons and to the environment.

All the rhetoric on the improbability of a spill, or on the abilities of plant personnel to control their processes, will not satisfy the demand of public agencies for spill-handling plans. Too many unpredictable accidents have happened under the most experienced hands. Neither the agencies nor the public need to be more proficient at handling chemical spills than the plant itself. What the agencies want is the feeling that the right action will be directed by those who should know what the right action is.

The key to adequate spill handling is decision-making. Spills cannot be prevented nor adequately disposed of if plant management cannot make quick and proper decisions on how to handle them. Decisions should be based on the selection of an alternative that provides the best possible result for the risk involved. The only help available from other sources to a decision-maker is the supply of information on the alternatives, the results, and the risks involved.

Most plants' safety, disaster or operating schemes do not fulfill the requirement for a spill-handling plan. For example, safety plans primarily instruct on how to avoid accidents to humans and how to treat them after injury. Disaster plans generally instruct on how to preserve life and property under only one situation: a catastrophic event. The list goes on as one discusses the manuals and procedures of the various departments in a plant: engineering, fire protection, plant utilities, health, training, etc. None of these manuals or procedures supply the information required to make the de-

Reprinted from **CHEMICAL ENGINEERING**, Aug. 18, 1975. Copyright © 1975 by McGraw-Hill Inc.
1221 Avenue of the Americas, New York, N.Y. 10020



Single-tank dike made of impervious Gunite

cisions necessary to cope with the spill of a hazardous material.

A chemical-spill-handling plan fulfills an information need; it does not program decisions. An examination of the devices that can be used as alternative defenses against spill problems, and an examination of how the spill-handling plan can be improved, constitute the scope of this report.

Spill prevention and containment

Before developing a chemical-spill-handling plan, an examination of spill-prevention and containment devices is desirable to define containment alternatives. All containment devices illustrated and discussed here are located at the Dow Chemical Western Div. in Pittsburg, Calif. This site has some 18 separate plants and has operated at zero wastewater discharge since May 1974. The only exception to this is the noncontact cooling water, which is drawn and returned to the confluence of the Sacramento and San Joaquin Rivers. This use of river water will cease in 1975, upon completion of the plants' cooling towers.

To become a zero discharger, the first steps toward spill prevention were the "buttoning-up" of plant wastes. As a general rule, all possible waste streams that can be reused in product manufacturing should be recycled, because it is usually profitable to do so. At the Western Div. of Dow, most waste streams ultimately end up at the brine plant, where NaCl brine solution is prepared for feed to chlor-alkali cells for chlorine and caustic production. Waste salt streams from various plants in the complex become raw-material streams at the brine plant. The brine plant can precipitate and settle nonusable salts and inert particulates for solids disposal.

Waste streams containing organics that cannot be recycled are placed in waste ponds, where solar evaporation and photochemical processes break down and concentrate nonusable and mostly environmentally hazardous organic compounds. This, of course, is practical where there is a climatological advantage in the use of solar waste ponds, such as a net 50-in/yr evaporation rate as exists at Dow's Western Div.

Fig. 1 and 2 (F/1, F/2) show two types of solar waste ponds. F/1—a polymer-lined solar waste pond—has a roundstone drain field under the polymer liner, with a second polymer liner under the drain field. F/2 has a clay-lined bottom over a concrete layer, under which there is a round-stone drain field, which has a polymer liner underneath. F/2 also shows the manhole from which seepage through the first clay liner and concrete layer into the drain field is pumped back to the pond. The polymer-lined pond in F/1 has a similar type of manhole access to its drain field.

Both of these ponds are designed with the underdrain field located between relatively impervious barriers to provide a drain field without a hydraulic head, which could prevent injection of waste fluids into the



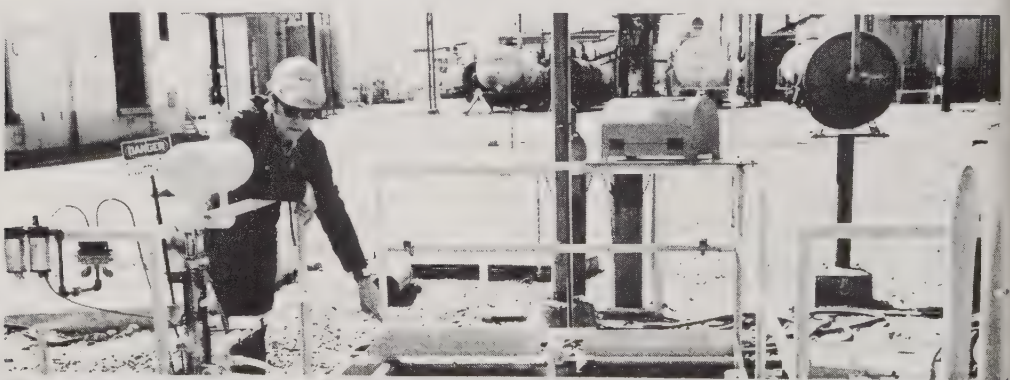
Solar waste pond with polymer lining (F 1)



Clay-lined solar waste pond with manhole access to drain field (F 2)



Metal-lined impervious dike coated with resin. Marine-loading terminal is shown in center (F 4)





Storm-drain diversion gate. Level flow-gage is on the railing, in the center of the photograph, at the side of the instrument house (F 6)

Drain sump for organo-sulfur-compound plant system. Spill and rainwater are pumped to recycling or to solar waste ponds F 3





Multi-product storage area with a large pervious dike F 5



Diversion conduit leading to various deposition alternatives F 7

ground-water geologic formations. Although minor seepage does permeate the immediate pond bottom, this is pumped from the drain field back to the pond. With no head on the fluid in the drain field, permeation of the underdrain barrier is relatively zero. With waste storage in ponds below ground levels, probabilities of spills due to containment ruptures are virtually eliminated.

Containment in plant areas

Next in the containment of spills is the plant process-area itself. The general practice at Dow's Western Div. is to install a pad with a curb and drain system in each plant.

F/3 shows a drain-system sump in an organo-sulfur-compound plant. Spill and rainwater are pumped from the sump to recycle or to the solar waste ponds. This sump has an overflow into a larger emergency holding basin—as shown in F/3—where a person is standing on the grate of the floor-drain system. Rainwater collected from the process area is treated as process wastewater unless chemical analysis proves the runoff is uncontaminated. This usually occurs when rainfall has washed the process area clean.

Storage-tank areas for raw and final products should be diked to contain 100% of the largest tank in the dike if the material is nonflammable, and 110% if the material is flammable. If the material is toxic and persistent in the environment, impervious-dike bottoms are required, such as shown in F/4 to the right of the person. This dike is lined with resin-coated sheet-metal that is covered with dirt, and metal joints are installed parallel to the dike slope. The person shown in the photograph is walking in the area diked for the pipes that serve the marine-loading terminal in the center. The figure on p. 83 shows an impervious dike of Gunite formed over the earth, while F/5 is a large pervious dike enclosing a multiproduct storage area.

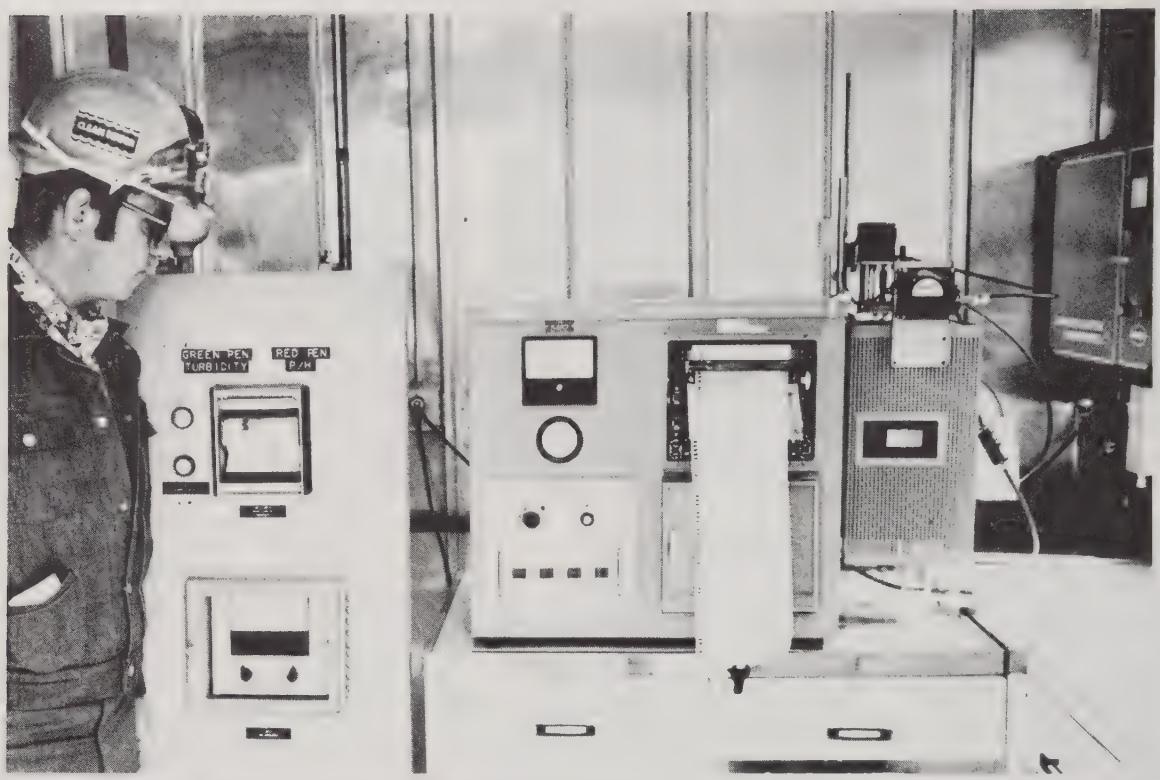
The final defense in the prevention and containment of liquid and solid spills should be at the end of the plant storm-drain system. Here, an automatic system should monitor the storm drain for acidity or alkalinity (pH), turbidity, total oxygen demand (TOD), and flow (variance from normal).

If any of the parameters are sensed beyond normal limits, a diversion gate should automatically move into position to divert the discharge to a holding pond. Such a system provides protection against a spill that goes beyond the process area and into the storm drains. Discharges diverted to the holding pond are removed to a process area for recycle, treatment or disposal.

F/6 shows a storm-drain diversion gate. Note that the gate is just below the center, while a flow gage (measured by level) is on the railing in the center. The instrument house is shown on the extreme right. A diversion conduit is shown in F/7, while F/8 shows the automatic monitoring instrumentation.

Since loading and unloading material offers one of the greatest spill potentials in a chemical plant, areas for such operations should be diked and drained. F/9 shows grates and drains under railroad-car-loading facilities, while F/10 shows the central sump for the rail-

(cont'd. on top of p. 87)



Monitoring instrumentation. All measurements, such as turbidity and pH, are automatic

F 8

Imbibitive polymers stop liquid flow*

R. H. Hall and D. H. Haigh, *Dow Chemical U.S.A.*†

☐ Imbibitive-polymer beads are designed to pass water but to imbibe, swell and seal when an organic fluid contacts the beads. In a normal close-packed bed of beads, there is about 30% void volume. This allows water to pass but becomes an automatic seal for many organic liquids that contact the beads, causing them to swell, as shown in F/A.

These polymers differ from most others normally dealt with. Most common plastics are totally soluble in a given organic solvent. The imbibitive polymers, however, have the capacity to drink in a large quantity of fluid without ever becoming completely dissolved. This holds true even in an excess of solvent.

The polymer can be prepared in many forms and shapes, but is conveniently available as small, solid spheres or beads. There are no pores or voids to fill, as in a sponge. As the beads swell, the fluid penetrates the polymer network, causing the size of the particle to increase. In doing so, no large pockets of fluid are formed that might later leak out; the solvent is actually entrapped by the molecular structure of the bead. In an excess of "good" solvent, the particles swell three diameters and effectively pick up and contain up to 27 volumes of fluid per volume of polymer.

Imbiber beads can be designed and built in different sizes, with different chemical building blocks and in varying degrees of cross-linkage. A fully imbibed bead can be cut in half with no fluid leakage. Similarly, it is impossible to squeeze imbibed fluid from the bead. This property to swell without dissolving is built into the polymer chains to prevent them from becoming free of the parent particle and entering the solvent.

Beads, made of an alkylstyrene polymer, imbibe a broad range of solvents: linear aliphatics such as hexane and gasoline; chlorinated solvents such as methylchloroform and trichlorobenzene; aromatic solvents such as benzene, styrene, and methylnaphthalene; and some polar materials, including methyl isobutyl ketone and tetrahydrofuran. Since the density of alkylstyrene beads is 0.95, they float on water, allowing maximum contact with many chemical spills.

The size of the bead is important, because the surface area is a function of the diameter. Therefore, decreasing the diameter by a factor of two results in four times as much surface area per unit volume. To obtain the fastest swell, the

* Although unrelated to the main report, this section has been included because it offers additional means of controlling spills. The material has been extracted from a paper presented at the AIChE-EPA-sponsored National Conference on Control of Hazardous Material Spills, San Francisco, Calif., Aug. 25-28, 1974.

† Both authors work for Dow Chemical U.S.A. Midland, MI 48640. **R. H. Hall** is Project Manager, Imbiber Systems, Engineering and Metal Products Dept. **D. H. Haigh** is Technical Representative for Imbiber Systems in the Central Research - Physical Research Laboratory.

road-car drains. Here, caustic and acid storage, with respective feed systems, are provided for neutralizing spilled waste. F/11 shows a combined railroad-car and truck-loading drain system.

For the prevention of vapor spills, odor monitoring should be performed at various locations by means of air-collection funnels that draw samples into a gas chromatograph for analyses. Vents from all process vessels containing problem vapors should be collected and processed through scrubbing devices. At Dow's Western Div., these devices are usually caustic-spray columns.

Spill-handling decisions

To prepare a spill-handling plan, one needs to define the decisions that must be made in a spill incident. First of all is the acceptance by the plant or process superintendent that a spill has occurred, based on information from his monitoring systems.

The most immediate steps should be those aimed at the protection of human life. There is an immediate need for information at the time of the spill-monitoring alarm, on the extent of the hazards of the spill. Therefore, one needs to know exactly what it is that is leaking. The answer to this question not only provides the name of the leaking material but also the equipment number such as "ethyl alcohol, Tank 33." If the information obtained shows that the threat to life is "immediate and great," the decision should be to "shut



Grates and drains under railroad-loading facilities F 9

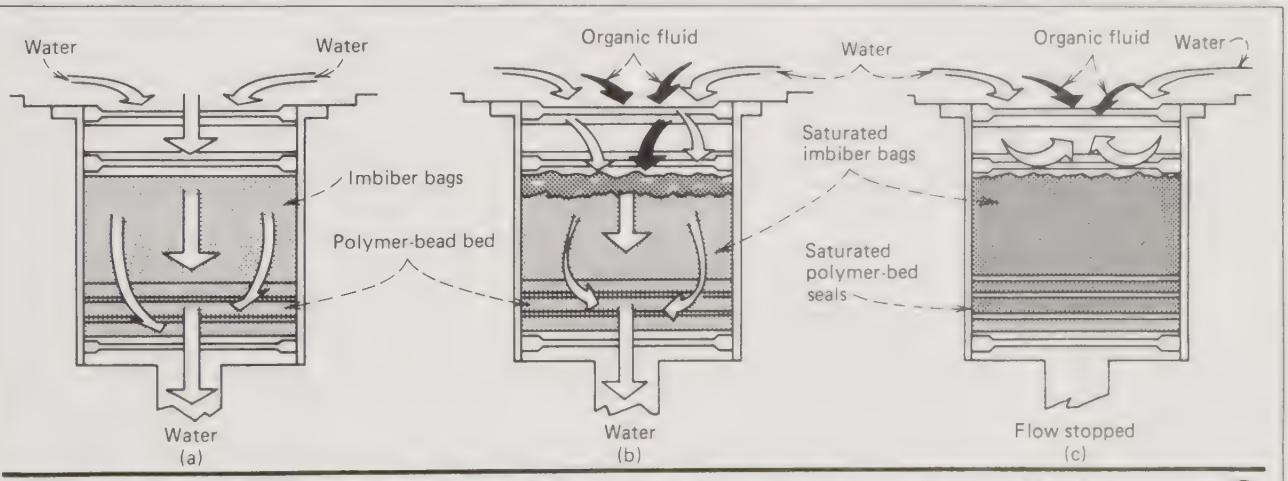
choice must be the smallest possible bead, but for the easiest (low-pressure drop) and fastest water flow, the largest bead is best. Therefore, the choice of size becomes a compromise.

Imbiber bags

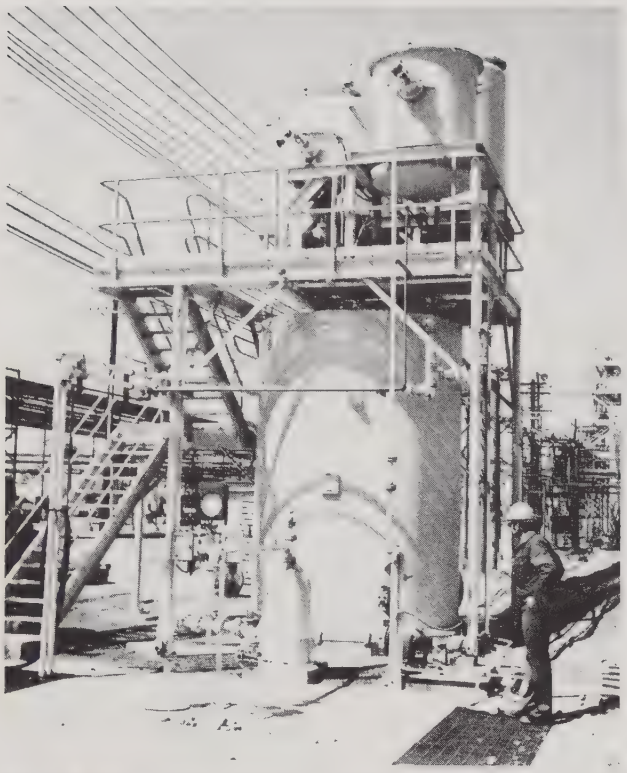
Since imbiber beads present a very slippery surface for walking, the beads are placed in packets called *imbiber bags*. The bag material is a very porous spun-bonded polyolefin that allows free migration of liquid into the packet.

Because the swelling characteristics of the beads allow only a shallow penetration of pollutant into a bead mass before sealoff occurs, it is necessary to prop the beads apart by incorporating a finely ground inert material as a "wick," which permits rapid capture of as much as 0.2 gal of liquid per 7-in × 7-in bag.

Imbiber bags can be used nearly anywhere that a spill occurs, because they "package" the spill for easy removal. The fabric of the bag is extremely tough, which permits it to be



Imbiber-bead bed. In (a) water flows freely through polymer bed, but as pollutants begin to flow in (b), the polymer begins to swell until no more water or pollutant exits through the bed, as in (c). A



Neutralization system, showing caustic and acid storage, for central sump of railroad-car drains

down—all persons take immediate cover." Otherwise, the decision should be to "clear up the area."

The "immediate cover" for persons is a spill response usually described by the plant disaster plan, whereas the protection of employees in the "cleaning up the area" procedure is ordinarily contained in a safety plan. It is the void of information between these two extremes that the spill-response plan should gap.

After the immediate threats are solved, the third decision to be made is to determine who is to be the leader of solving the problem; or better yet, who can make the best decisions on containment and deposition. Once the leader has been chosen, the decision-making process continues.

The final decisions of this process are selecting, first, a containment action, and then a deposition procedure. Both of these decisions, however, need information on the relative availability and environmental safety of alternative containment and deposition means. F/12 diagrams the decision-making process and the information needed in a spill-handling situation, as well as the requirements for improving the spill response.

Spill-handling plans

Most important is the examination of what not to do in a spill-handling plan. Also, actions during a spill should not be preprogrammed. What follows should explain both of these statements.

grommeted to form a boom or blanket so that it can be used as a barrier across streams.

Until recently, the purpose of a diked area surrounding a bulk-storage tank or a tank farm was the containment of a spill after a tank rupture or line break. However, most of these diked areas were not designed to prevent seepage or leaching into surface or ground waters. Increased environmental emphasis has classified this seeping and leaching as a serious pollution source, and has resulted in the imposition of strict rules governing such storage areas.

To avoid such seepage, dike floors and walls can be lined with an impervious polymer membrane or constructed of a compacted clay with proper pore size and sufficient depth to prevent leaching. However, a barrier constructed to be impervious to hazardous chemicals is most assuredly impervious to water as well. In the event of a line or tank failure or a sustained tank leak, even the best water separators can be overloaded, thereby freeing polluting chemicals to the environment.

One way to avoid this is to allow the fluids to pass through an assembly that has a trash and silt filter, and then into a chamber containing imbiber bags. The bags continue to allow passage of water, but remove small quantities of pollutants. The cleaned water then passes through an imbiber-bead bed to a suitable drain. If, however, a massive leak or rupture occurs within the diked area, the spill can overwhelm the capacity of the bag chamber and enter the bead bed, causing the imbiber beads to swell and seal against further flow of pollutant or water, thus containing the spill.

Routine maintenance of such devices includes inspection and cleaning of the trash filter, and removal and replacement of affected imbiber bags. If the imbiber-bead bed has been affected, it too must be replaced. However, the maintenance of the filter and of the bag chamber usually protects the bead bed from all except large spills.

Imbiber valves

Automatic-sealing imbiber valves consist of a metal cylinder with necked openings at each end, and filled with imbiber beads retained by supported porous membranes (F/B). If at any time the valve were left partly opened (valve defect or operator's inattention), no product is lost and a hazardous spill is eliminated.

Bulk-storage tanks containing gasoline, benzene, toluene, xylene, styrene, ethylbenzene and other fluids may accumulate a water layer—due to inflow from open or floating heads, condensation and pumping—which must be regularly removed to prevent contamination of the material being produced, as well as tank corrosion.

Often, it takes hours (sometimes days) for complete removal of the water. Inattention, which is likely to occur over such long periods, could result in loss of valuable product, increased fire hazard, and environmental pollution. But if imbiber valves are used, the flow need no longer be monitored because when the interface is reached, the valve automatically stops the outflow.

Other applications

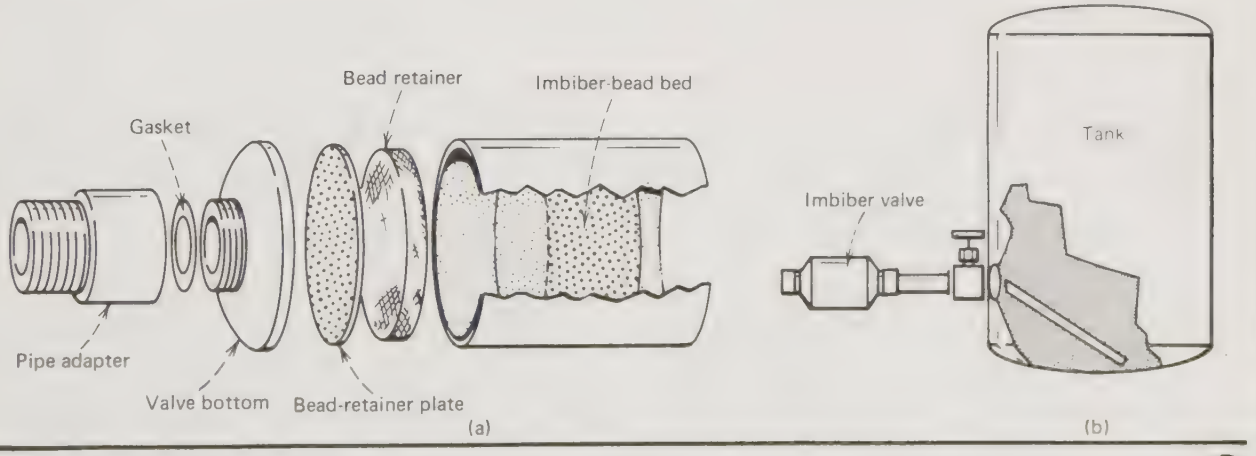
A further application of imbibitive polymers is illustrated by the *burn box.* This is a 1-gal plastic container with a quart of *Imbiber Beads V* (U.S. Patent 3,881,295) to solidify many hazardous liquids. The shipment of a unit to an EPA-ap-



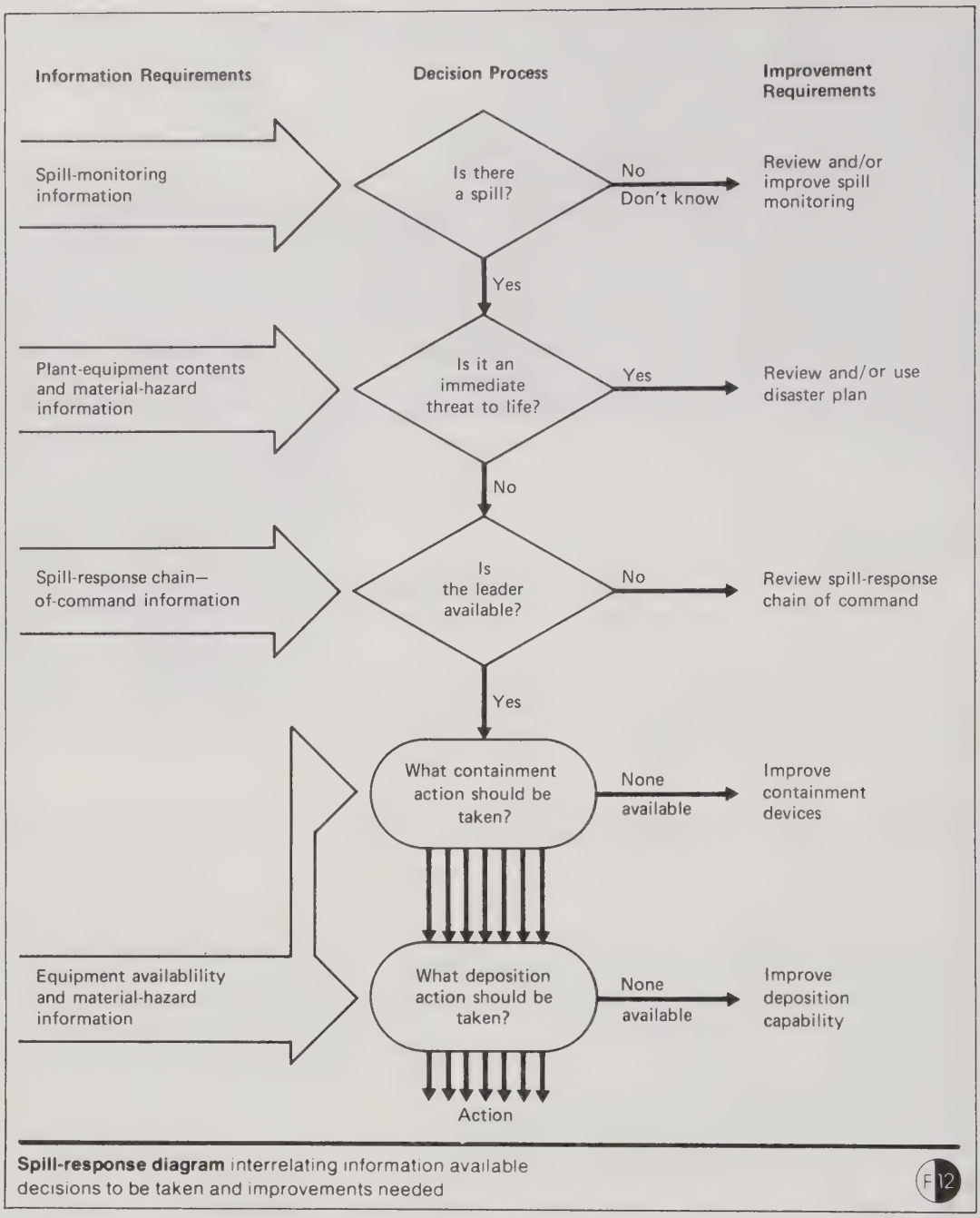
Drain system for combined railroad- and truck-loading drain system

proved incineration facility can be made with minimal hazard when compared to fluids contained in glass or cans. These are usually protected by cardboard or plastic cushioning that do not prevent the fluid from spilling outside of the container package.

Another, more-recent, application is the *imbiber shipping pouch.* Many hazardous chemicals are packaged in glass, but if the cap, seal or glass leaks, a pouch with imbiber polymer surrounding the bottle can be used to pick up and contain the fluid so that it cannot leak any further. A part of this packaging system is a barrier film-bag around the pouch to provide time for the beads to absorb and to help control the vapor. If there is no loss of product from the bottle or container, the pouch can be reused.



Imbiber valve is shown in a cutaway schematic (a). Valve applied to a tank exit is shown in (b).



Spill-response diagram interrelating information available decisions to be taken and improvements needed

F12

Action, in this context, means equipment-motivating activity such as valve turning, switch manipulation, etc. Such actions in a chemical process are usually well known by process operators, because these actions are subject to frequent changes involving the process, equipment and plumbing. It is difficult, however, to document these changes frequently.

To preprogram all such actions for all possible spills would produce a document of dictionary size, which would not be read in anticipation of a spill, and could not possibly be consulted in a spill-containment operation. A document of this type contributes nothing to a spill response. In short, practically all operators of a plant know how to operate every piece of equipment within the plant's boundaries.

What is usually not well known is what equipment should be operated to accomplish a given purpose during a spill. In other words, it is the decisions that must be made to contain and dispose of a spill that should be known.

Programming such decisions, however, presents too many alternatives and risks to be presented in a manual. What can be done is to collect, evaluate and present in a concise set of tables the information necessary to make spill-handling decisions.

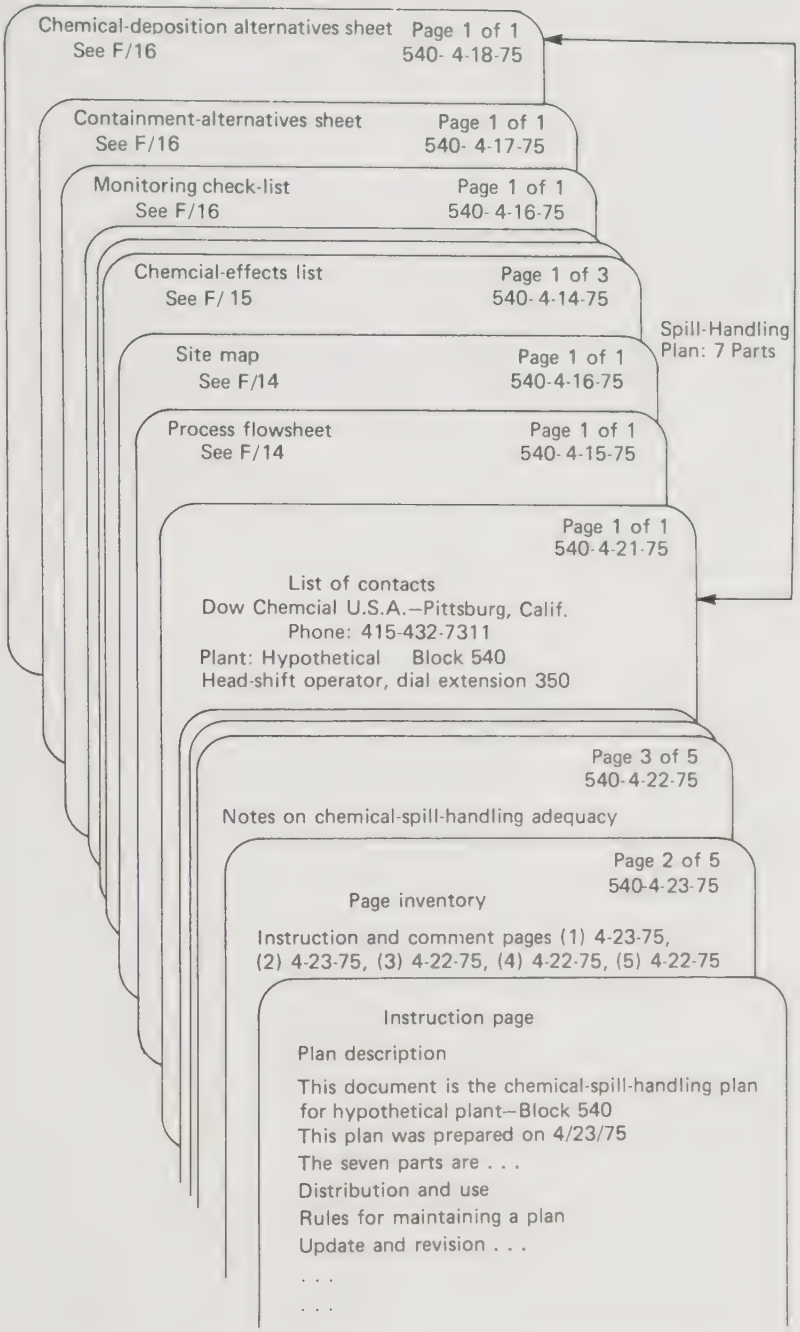
Therefore, a spill-handling plan should be an easy-to-consult document for decision-making. How should one go about preparing such a document? F/13 contains a list of information requirements to fulfill the needs of the decision-maker during a spill incident.

Thus, a chemical-spill-handling plan should include:

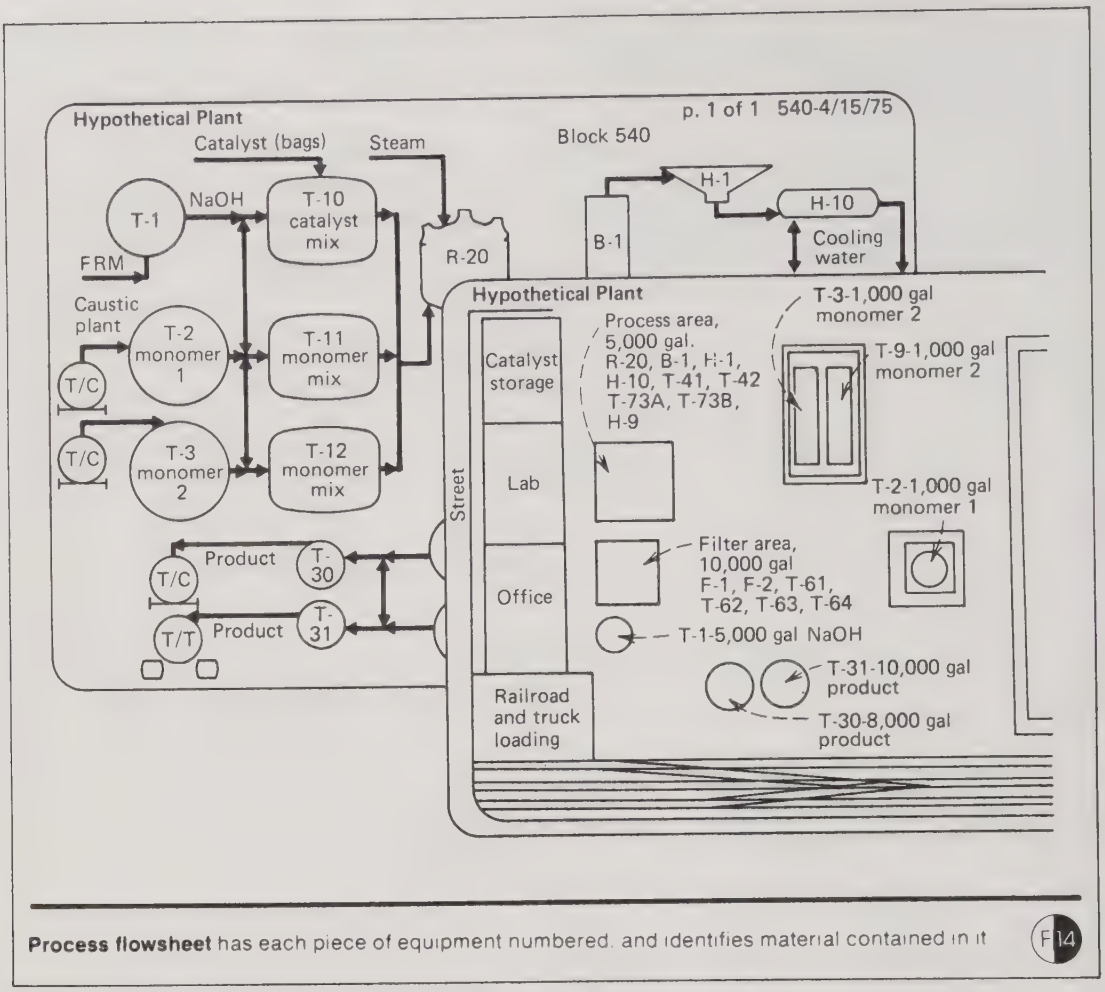
1. Monitoring of possible spills of materials.
2. Identification of all plant equipment and whatever contents it may have.
3. Hazards of materials that comprise potential spills.
4. The chain of command during a spill.
5. Equipment availability for containment, and deposition alternatives in response to a spill.

At the Dow Western Div. in Pittsburg, Calif., for example, there are 18 independent plant operations, each with its own management and real estate. Each plant has its separate chemical-spill-handling plan.

Every one of the plans has *seven relatively independent parts* that fulfill the five needs mentioned above. These parts are kept as independent as possible to facilitate the updating of each one. F/13 shows an outline of these seven parts, in which a hypothetical plant was used as an example.



Chemical-spill handling-plan schematic F 13



Process flowsheet has each piece of equipment numbered, and identifies material contained in it F14

List of contacts for spill emergencies

The first part of the spill plan contains a *list of contacts*, which identifies the individuals to be contacted in the event of a spill; foreman, assistant superintendent; superintendent; department manager (responsible for several plants); superintendent for all plants at the site on the particular shift; and also safety, environmental control, and government agencies. Names and office and home telephones must be given. The part of the plan provides the information for Requirement 4 above on the *chain of command.*

Plant equipment and contents

The second and third parts of the spill plan fulfill Requirement 2 above for information on plant equipment and equipment contents. The second part consists of the *process flowsheet*, which is a schematic drawing of plant processes, showing the flow of materials from one piece of equipment to another. The general rule is to show those pieces of equipment containing sufficient volume of material to constitute a potential spill problem, and only those other pieces of equipment necessary to follow the material flow throughout the plant.

Therefore, at least all vessels of 500-gal capacity should be shown. Pumps, valves, piping, and electrical circuits and controls usually are not included in the flowsheet. Heat exchangers, which generally contain small volumes at any one time, are ordinarily shown to follow the flow of material. The process flowsheet starts with material entering the plant and ends when the material leaves the plant. The flowsheet should identify at all times what material is in what equipment (F/14).

Site map for the spill plan

The third part of the plan is the *site map*, which shows the location of all equipment on the process flowsheet. Each piece of equipment should be identified according to the plant's code, the equipment's maximum volume (preferably in gallons), and the type of material in the equipment. The map should also identify the geographic boundaries for the particular plant for spill responsibilities (F/14).

Chemical-effects list

A *chemical-effects list* constitutes the fourth part of the spill plan. This list should have an itemization of all materials located within the boundaries of the plant. For each material, environmentally important physical, chemical, biological and toxicological properties—plus some health effects—should be listed.

The chemical-effects list fulfills Requirement 3 on information on the hazards of the various materials contained within the plant.

As can be seen from F/15—where the chemical-

effects-list entry for methanol is shown—the list is produced from standard, automatic, data-processing punch cards. F/15 shows that nonconstrained text entries are allowed (with 78 punched in columns 77 and 78). These cards we call "effect property cards." Such a card-listing system allows single-line corrections, deletions and additions without retyping of the data, as an actual typed list would require.

At the Dow Western Div. site, a deck of punch cards is prepared only once for each material. The individual decks for each material are filed alphabetically with a tab index card, and with the desired blank cards for spacing. To prepare a chemical-effects list for a particular plant, the decks for each material in the plant should be placed in alphabetical order. Title cards are placed at the beginning of the combined deck, and then the cards are listed on any available automatic, data-processing-listing machine.

No other special computer is required. If the deck is dropped or gets out of order for any reason, it can be sorted back to order on a card-sorting machine, by sorting on the last eight digits. This must be done in reverse order from columns 80 through 73, treating blanks as zeros. After the list is prepared, the decks for each material must be refiled back into the master file of cards. In actual practice, materials were inventoried on a plant-by-plant basis, and the deck for each individual material was prepared as needed.

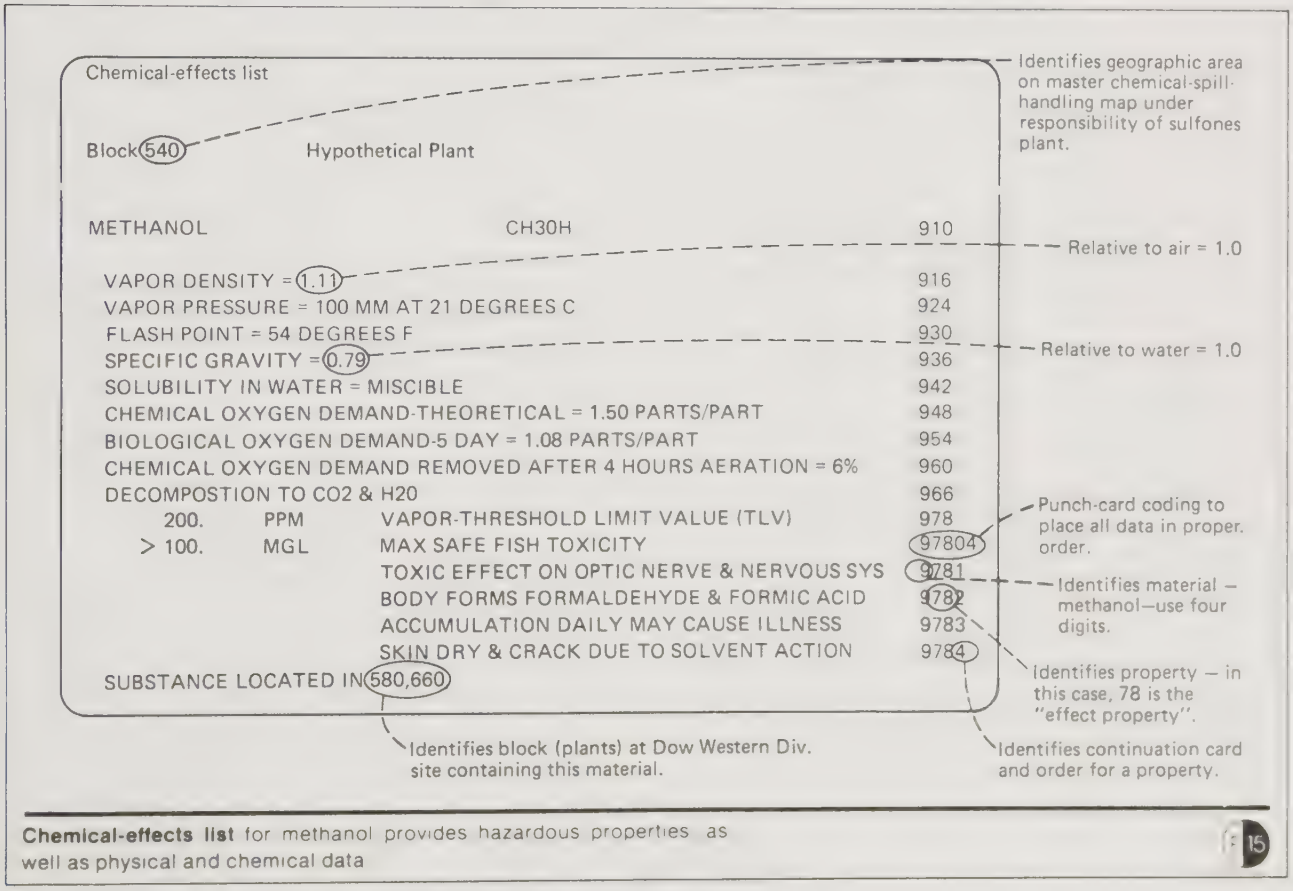
The material properties selected should be those that should be known immediately for a spill-response decision, so that they can be quickly read in the time constraints imposed by an emergency. A list of 20 or so materials consists of four to five pages, which can be posted in a plant's control room. Basically, the list attempts to define fire hazard, air and water compatibility, chemical and biological decomposition characteristics, and effect of liquid and vapor on humans, as well as on fish and plants.

As expected, the most difficult problem in preparing a master list of substances in a large chemical complex is that of names. After some confusing attempts in applying chemical names, the Dow Western Div. adopted the use of tradenames. The reason for this is that the "Material Safety Data Sheet"—required by the U.S. Dept. of Labor under the requirements of Form OSHA 20—is the best source of data needed for the list.

In many instances, these Material Safety Data Sheets are the only source of data for proprietary compounds, where such compounds are listed by their tradenames. If an intermediate material is not sold as a final product, the manufacturer usually has some safe-handling data or product test-data for the compound. These data are usually referenced also by experimental or intermediate names.

At the Western Div. of Dow, the rule is to use tradenames, resorting to chemical names only if no tradename is available, or if the chemical name and the properties of the material are well known (sulfuric acid, methanol, methane, etc.).

In starting a listing of materials and their associated



Chemical-effects list for methanol provides hazardous properties as well as physical and chemical data

properties, punch-card printings and other fancy data presentations should be postponed until a complete listing is finished, the material name has been settled, and all data have been collected for almost all materials. Once the list of names of materials located on the site has been assembled, data can be more easily collected, checked and presented for use.

The fifth, sixth and seventh parts of the chemical-spill-handling plan are similar in format, each part being a matrix. These parts fulfill Requirements 1 and 4 above. Both the process flowsheet and the site map are necessary for the preparation of these parts.

Monitoring checklist

This fifth part of the list—called a *monitoring checklist*—consists of a matrix. The rows identify individual monitoring activities and capabilities, while the columns identify each piece of equipment in the plant, as shown on the process flowsheet. Check marks are placed in the row or in column boxes, indicating how the equipment is monitored for potential spills. The most probable "first" sensing of a spill is circled to judge the maximum time span between a spill and its recognition by plant personnel. F/16 shows an example of a monitoring checklist. Various pieces of equipment can be grouped in a single column if all such equipment is monitored in exactly the same fashion. Visual monitoring—which is acceptable—can be continuous or every two, four or eight hours per shift.

Equipment containing materials with strong odors are considered monitored for spills if plant personnel can immediately detect leaks by their odors. Process-control-room gages, recorders and alarms are all monitoring equipment, as well as automatic sump pumps and fire-fighting sprinkling systems. Any method of detection of a spill is considered a monitoring device on the monitoring matrix.

The monitoring checklist is more of a prevention-planning document than a spill-response information document. It is on this monitoring matrix that the ability to adequately recognize a spill depends.

Hypothetical Plant Block 540 — Chemical-spill-handling plan, Chemical-deposition alternatives

Deposition \ Equipment	T-3 T-4	T-2	T-30 T-31	T-1	F-1 F-2
Drum & ship to disposal site					1
Railroad tank car	4	4	1	3	3
Tank truck			1	1	2
T-11	2	1			
T-12	1	2			
R-20	3	3			
T-10				2	

Hypothetical Plant Block 540 — Chemical spill handling plan, Containment alternatives

Containments \ Equipment	T-3 T-4	T-2	T-30 31,1	Filter area	Process area
Diked area (thousand gallons)	1 (30)	1 (2)			
Storage area Floor drain & sump - 10,000 gal			1	2	
Sewer & divert to shock pond			2	3	4

Proces floor / Waste / Perco

Hypothetical Plant Block 540 — Chemical spill handling plan, Monitoring checklist, ◯ Indicates first probable sensing

Monitoring method \ Equipment	T-3 T-4	T-2	T-30 T-31	T-1	Filter area
Visual inspection every 2 hours	X	X	Ⓧ	Ⓧ	
Odor-sensitive	Ⓧ	Ⓧ			
Hydrocarbon-vapor alarm, 25 ppm	Ⓧ				
Level alarm		X	X	X	

Alternative matrices for deposition, containment and monitoring alternatives (F16)

Containment alternatives

The *containment alternatives sheet* is also a matrix, with process equipment identified in the rows, and levels of containment identified in the various columns. Again, equipment may be grouped, but only if the containment plans for the various pieces grouped are identical. In almost all cases, containment alternatives are not really alternatives, but a series of containments that occur in sequential order, as the spill increases (F/16).

Specifically, the alternatives matrix is prepared by listing various types of containment, and then indicating in which order these containments would be utilized if a particular piece of equipment were to spill its contents. The indication in the proper row or column position is done with a number, which indicates the order of use of the containment. The number within the parenthesis indicates the various volumes contained.

For example, let us assume the existence of three 20,000-gal tanks—T-1, T-2 and T-3—each one containing methanol and located in a common pervious diked area with a 30,000-gal capacity. The tanks would be grouped in a column entry. In a row identified as (pervious) "Diked Area (thousand gallons)," a No. 1 would be entered, with 30.0 entered within a parenthesis below the 1. If two tanks leaked, or the dike failed to contain one of the tanks, the spill would move to a drain ditch along the road. Therefore, a No. 2 is entered in the row identified as "Drain-Ditch Along Road." Since the dike is pervious, a No. 2 also is entered in the row identified as "Percolate Into Soil."

If the volume of the spill were still not contained, entries would go on through "3, 4, 5" and so on, until containment of all possible spilled material were achieved. For instance, the entries could be "3-Enter Storm Drain at Corner of X and Y Streets, 4-Diversion to Shock Pond based on TOD (by automatic sewer-monitoring gate), and 5-Shock Pond." Volumes of the various containment levels would be listed below the number entry.

Environmental incident report

Incident report no. _____

Date of incident _____

Description of incident

Cause

Action taken to control spill

Proposed corrective action

Copies to:

Division manager
Engineering manager
Environmental manager
Department manager

_____
Superintendent

_____
Department manager

_____
Date of report

Incident report form for environmental control

F 17

The containment alternatives tell the decision-maker where the spill is finally coming to rest; the route the spill is going to take; and—probably most important of all—how much time (as an estimate, based on the size of the leak and the containment alternatives) the decision-maker has to react.

Chemical-deposition alternatives

The seventh and final matrix—the *chemical deposition alternatives*—is similar to the sixth in that it also uses numbered entries instead of checks. In this matrix, equipment is again listed in groups in the columns. However, the rows in this matrix are a listing of equipment that are considered alternative places of material deposition.

These equipment alternatives may range from: (1) into another tank (possibly a tank within the same dike); (2) into process or other equipment; (3) into a tank car or tank truck; (4) into a drum; (5) into a waste pond; (6) into a shock pond; and so on down the list. The row or column entries on this matrix are various numbers that indicate the deposition order of preference, if it is available, to be able to deal with the spilled hazardous substance.

Alternatives of the equipment entries on this matrix may also be grouped, if the alternatives for depositon are identical. Keep in mind that the criterion for grouping for each of the three matrices is different. Therefore, using the same equipment grouping from one matrix to the next is not usually possible.

The foregoing seven parts constitute a chemical-spill-handling plan. The last three parts are not wholly independent of the other parts because equipment and materials from the process flowsheet and site map are referenced on the three matrices. Therefore, process changes may require revision of the chemical-spill-plan matrices. To facilitate revision, pages are dated individually and numbered within each part. An instruction page, a list of dates for current pages, and a set of comment pages on the plan's adequacy are included. See F/13 for the complete schematic of a chemical-spill-handling plan.

Note that the spill plan nowhere instructs one on what action to perform if this or that spill occurs. The plan presents on paper as many alternatives as needed for an adequate response to spill incidents.

Improving prevention and response

The completion of a chemical-spill-handling plan does not in itself guarantee adequate spill handling, or even an improvement in capabilities to handle spills. Hopefully, it informs of the best spill-handling means possible. Three mechanisms are used at the Dow Western Div. site for improving spill prevention and alternatives for response.

First, is the *plan-adequacy page* that is prepared at the

completion of a chemical-spill-handling plan. This page is inserted in the plan and consists of comments regarding the plant's capability to prevent and handle chemical spills. Environmental-control personnel at Dow perform the plan review and write the adequacy page. Key items that are noted on the page are:

1. Does the plant have a complete chain of command for spill response, or could a situation arise where there is indecision as to who is in charge of handling what spill? The question of which person is in charge of what equipment is sometimes debatable. When various plants exist within the site of a chemical complex, indecisive action may occur as each plant superintendent thinks the spill is another superintendent's responsibility. At multiplant complexes, real-estate boundaries should be settled before spill-handling plans are started.

2. Process equipment can be difficult to identify during a spill, if the equipment is not actually marked as it is recorded on the process flowsheet. Incorrect tank or equipment numbers interfere seriously with proper spill responses.

3. Supposedly unused pieces of equipment (especially tanks) are potential spill hazards because very often something has been stored in them by plant personnel not responsible for spill prevention. All tanks must be shown on the site map, unless they are actually sealed or cut off from any possible service.

4. Any inability to identify materials stored on the plant's property constitutes an inadequacy for spill protection.

5. On monitoring, the rule was established at Dow's Western Div. that no piece of equipment should be capable of leaking for two hours or more without being detected. Therefore, any visual tank inspections at frequencies greater than two hours constitutes inadequate monitoring.

6. Any vessel or tank, containing material other than water, that is not diked is an inadequacy in the plan. Liquefied gases under pressure (anhydrous ammonia, petroleum gas, chlorine, etc.) that would vaporize immediately upon a tank lead need not always be diked.

7. Any possible discharge to a river by a spill is inadequate spill protection.

8. Any toxic and persistent material not stored in an impervious dike area is also an inadequacy in the spill-protection plan.

9. Less than three material-deposition alternatives for liquid and solid spills is inadequate. More alternatives should be sought out or installed.

Second in importance in improving spill-handling plans is that they must always be up-to-date. This should be the plant superintendent's responsibility. If process changes occur, plant personnel should be instructed to submit revised spill-handling plans.

If the spill plan is not revised within a year, the environmental-control group should submit a "list of chemical effects" to the plant superintendent. This is to trigger a review and an updating of the plan. Minimally, the plant superintendent should sign his name certifying the currentness of his spill-handling plan.

The third and last spill-response and prevention-improvement technique is the *environmental-incident report*. Each time a plant accidentally releases or spills a gas, liquid or solid that could result in a discharge to the environment, an environmental-incident report must be filed by the plant superintendent. These reports are essentially inhouse citations for improper operations—either intentional or accidental. The report requires an investigation similar to the one that would be needed if an accident had occurred (see F/17).

The operating board

Each incident report—which should be filed within a week—should be discussed by the *operating board* at its weekly meeting. Such a board should consist of the division's general manager, his immediate staff, and his department managers. The discussion should emphasize an analysis of the cause of the incident, as well as what future preventive action can be taken. Statistics should be kept for each plant on the number of incidents, and these should be reported at each meeting.

The purpose of the operating board is twofold. First, the review provides an analysis of potential problems and corrective measures for application to similar situations in the plant. And second, the review provides decisions on taking corrective action against future spills. Corrective actions—especially those requiring the installation of equipment—should be recorded and monitored for action by the environmental-control staff.

In conclusion, we believe that a chemical-spill-handling plan as defined here—with proper reviews for adequacy and updating—is capable of providing the means required by the public and government agencies in fulfilling demands for environmental protection.

References

1. "Control of Hazardous Material Spills," Proceedings of the 1974 National Conference on Control of Hazardous Material Spills sponsored by AIChE, San Francisco, Calif., Aug. 25-28, 1974.
2. "Fire Protection Guide on Hazardous Materials," National Fire Protection Assn. International, Boston, Mass., 5th ed., 1973.
3. "Laboratory Waste Disposal Manual," Manufacturing Chemists Assn., Inc., Washington, D.C., revised Nov. 1972.
4. Sax, N. Irving, "Dangerous Properties of Industrial Materials," Van Nostrand Reinhold, New York, 3rd ed., 1968.

The author



George F. Wirth is with Dow Chemical U.S.A., Western Div., Box 1398, Pittsburg, CA 94565 as member of the President's Executive Interchange Program. Employed by EPA, he directed the national water-quality monitoring program, and has had many assignments in economics, public policy and information systems in technical matters. Holder of a B.S. degree in geological engineering from St. Louis University and an M.S. in political science from MIT, he is a licensed civil engineer in the District of Columbia.

Reprints

Reprints of this report will soon be available. To order, check No. 230 on the order form in the back of this or any subsequent issue. The price per copy is $2.50.

Navigation XV

CHAPTER XV

SHIPPING AND NAVIGATION

Many commentors have indicated that the increased utilization of the existing navigational channels in the Sacramento River will increase the potential risk of collisions, groundings, and other accidents. The design of the project should minimize the possibilities of these events by providing adequate space, appropriate control, necessary aids to navigation, and restrictive rules of operation. These subjects are discussed in this chapter.

In response to comments regarding the increase in shipping in San Francisco Bay and the Delta, the following information has been developed to provide additional data on this subject.

PETROLEUM AND CHEMICAL SHIPPING

Over 1.2 billion tons of petroleum is moved over the waterways of the earth each year. Approximately 60 percent of this total consists of crude oil and the remaining 40 percent is various petroleum products. Within the Greater San Francisco Bay Area, about 75 percent of the ship movement in the Bay involves transportation of petroleum or an estimated 47.3 million tons of petroleum annually.

Total waterborne commerce of San Francisco Bay and Delta areas during 1973 is summarized below:

Locality*	Total Tonnage Short Tons	% of Total
Carquinez Strait	15,264,037	24.16
Suisun Bay Channel	2,319,229	3.68
Sacramento River	2,044,519	3.24
San Joaquin River and Tributaries	3,720,593	5.90
San Pablo Bay and Mare Island Strait	5,316,457	8.43
Richmond Harbor	18,259,836	28.94
San Francisco Harbor	4,485,745	7.11
San Francisco Bay and other Ports	3,490,409	5.53
Total	63,093,273*	100*

Source: U. S. Army Corps of Engineers
Waterborne Commerce of the United States, 1973

*Total includes adjustment for one-half of internal traffic.

The proposed Dow project will increase the movement of both ships and barges in the Bay-Delta area. Since the Draft EIR was written, a new estimate has been made of waterborne movement of products and raw materials. Results of this analysis included the transport of salt, caustic soda, and other products by barge locally in the Bay Area and to other Pacific ports. A summary of the waterborne movement of materials associated with the proposed project once it is fully operational is shown in the following table:

SUMMARY OF WATERBORNE COMMERCE
RESULTING FROM THE PROPOSED PROJECT

Material Transported	Mode of Transport	Destination	Annual Tonnage (Short Tons)	Number Vessels Annually
Naphtha	Shallow draft tanker ≈18,000-ton capacity	Montezuma site from various ports	1,750,000	97
Salt	Barge - 10,000-ton capacity	Pittsburg	870,000	87
Isomers of butane & pentane + styrene	Barge - 10,000-ton capacity	Bay Area refineries & Los Angeles	710,000	71
Caustic soda	Barge - 10,000-ton capacity	Pacific ports	310,000	31
Total Annual Waterborne Commerce Resulting From Project			3,640,000	286

This additional shipping amounts to a six percent increase in the total Bay-Delta waterborne commerce for 1973 both in terms of tonnage shipped and number of vessels.

The increase in tonnage of hazardous cargo moving through the Golden Gate will amount to approximately 2.5 million tons per year, or about a five percent increase in Bay Area shipment of hazardous materials such as petroleum or certain chemicals.

Shipping will substantially increase in the Carquinez Strait, Suisun Bay Channel, the Sacramento River, and San Joaquin River near Pittsburg. A summary of hazardous materials transported by water in the Sacramento and San Joaquin Rivers in 1973 is shown below:

PETROLEUM AND CHEMICAL PRODUCTS TRANSPORTED IN DELTA AREA, 1973 (tons)

Product	Sacramento River[1]	San Joaquin River[2]
Gasoline	72,996	211,185
Jet fuel	10,564	147,458
Kerosene	2,118	62,615
Distillate fuel oil	22,748	106,170
Residual fuel oil	2,193	5,485
Basic chemicals	19,929	--
Misc. chemical products	5,975	--
Total petroleum and Chemical tonnage	136,525	532,913

[1]Includes Deep Water Ship Channel and Port of Sacramento
[2]Includes Port of Stockton

Source: U. S. Army Corps of Engineers
Waterborne Commerce of the United States, 1973.

The increased shipping at the Montezuma site in the Sacramento River would result in an 18-fold increase over the 1973 total tonnage of hazardous materials transported on the Sacramento River. The increase is only in the Collinsville area and not in the Sacramento Deep Water Ship Channel or other Delta areas.

Shipping of caustic soda from the Pittsburg site amounts to an estimated 58 percent increase over 1973 shipment of hazardous cargo on the San Joaquin River.

SPACE

The dock at the Montezuma facility will be located in a relatively wide portion of the Sacramento River (for detailed data, see Nautical Chart 18661 published by the National Oceanic and Atmospheric Administration, Edition 6, April 1975). The River in this area has depths in excess of 20 feet below mean lower low water over a width of about 2,000 feet. Therefore, adequate space would be provided for barge traffic and recreational boaters to avoid the dock. The dock is also set back 250 feet from the north side of the Sacramento Ship Channel as shown in Public Notice No. 5687, Sacramento District Corps of Engineers, dated 29 August 1975 (copy attached). This setback is equal to that provided in the most recently authorized construction of a new pier near Martinez, California, permitted by the U. S. Army Corps of Engineers and by the U. S. Coast Guard. This latter facility is located in Suisun Bay where there are less restrictions on speed of vessels and where vessel traffic is heavier because the channel handles traffic from the Sacramento Basin, Suisun Bay, and Stockton Ship Channel (for detailed data, see Department of Army Permit No. 5137 issued by Sacramento District Corps of Engineers, 9 October 1973).

Further recognition of the fact that the navigation constrictions in this area are not considered to be critical can be inferred from the fact that the regulations of the U. S. Army Corps of Engineers establish no speed limitations for this area of the channel. Areas of concern, on the other hand, have specific limitations imposed. For example, Title 33 of the Federal Code, Navigation and Navigable Waters, Chapter 2, Corps of Engineers, paragraph 207.640, page 221, shown as follows:

> "(p) Sacramento Deep Water Ship Channel between Suisun Bay and easterly end of Turning Basin at West Sacramento; use, administration, and navigation--(1) Maximum speed for all ocean going craft--(i) Between Toland Landing (Mile 6.2) and Rio Vista Bridge. When going against a current of two knots or more, the maximum speed over the bottom shall not exceed 8 knots. When going with the current, in slack water, or against a current of two knots or less, the maximum speed through the water shall not exceed 10 knots."
>
> Explanatory Note: Toland Landing is upstream approximately 1½ miles from the location of the dock proposed by The Dow Chemical Company. These restrictions do not pertain to the areas downstream from Toland Landing nor in Suisun Bay.

To provide for additional space for maneuvering ships that will be tied up at the Dow dock, a turning basin has been proposed as shown in Public Notice 5687. This turning basin is larger than the minimum size recommended by representatives of the Masters Mates and Pilot's Union who stated that the area should be two times as long and one and one-half times as wide as the length of the largest ship to use the facility. This size will provide adequate space for ships to get out of the channel when necessary to provide for passing of other ships if required and will minimize the possibility of groundings in this area.

CONTROLS

All ships that navigate the Sacramento Deep Water Channel are controlled by the Port of Sacramento through the use of pilots. Regulations regarding these matters have been published by the Port of Sacramento dated September 19, 1975, and are quoted as follows:

"1. Vessel Priority. The Port of Sacramento will have complete control and general direction of all vessels in establishing vessel priority.

It will be the duty of each pilot bound for Sacramento to contact the Operations Department by land phone, either before proceeding out to the anchorage or before the vessel leaves the dock, giving his draft, ETA New York Point and Port of Sacramento, and requesting clearance to proceed. Further, it will be the duty of each pilot to inquire from Marine Exchange about all outward traffic that might be met between New York Point and the Southern Pacific Bridge.

Clearance from Operations Manager will be required when leaving Sacramento. When boarding a vessel at Sacramento, each pilot will contact the Port's Main Gate either by telephone or radio and furnish his ETD Sacramento and ETA New York Point.

2. Position Reports. The following vessel positions are to be reported by radio to the Port's Main Gate giving the time of each passing:

1. S.P. Bridge
2. New York Point
3. Rio Vista Bridge
4. Beacon 53
5. Beacon 65

Any time a vessel is required to anchor, the Port's Main Gate will be notified of the position and time of such occurrence.

3. Draft of Vessels. A pilot will not navigate the Sacramento Deep Water Channel with a vessel having a draft of over 30'0", except with the specific approval of the Operations Manager for each such transit.

4. Collision and Groundings. Pilots will render a written report within 5 days to the Operations Manager of any and all collisions, of any nature whatsoever, and whether or not any damage was sustained by vessels or other property. A collision will be reported immediately by radio to the Port's Main Gate advising of the location and names of vessels or other objects involved. All groundings are to be reported immediately by radio giving the time, location and condition of the vessel.

5. Observance of Speed Limits. The speed limits for the Sacramento Deep Water Channel as promulgated in the Corps of Engineers' regulations shall be strictly observed. In addition, pilots will take particular care with deep-laden vessels and others whose characteristics may produce an unusually high wash or suction. Damage to floating equipment, levees or shore installations caused by improper or incautious vessel handling will make the pilot liable to disciplinary action.

6. Pilots Report. Within 48 hours of the termination of each trip, to or from the Port of Sacramento, the pilot will file a Pilot Report with the Operations Manager.

7. Familiarization Trip. A pilot may not take charge of a vessel unless he has within the previous 120 days completed a trip in the same direction as the comtemplated trip. In instances where the trip is made as an observer pilot, written notification of such observer trip, counter-signed by the actual pilot of the vessel, shall be filed with the Operations Manager of the Port."

The controls indicated in the regulations cited minimize the possibilities of vessels meeting in narrow parts of the River and can limit the channel to having one ship in it at a time.

AIDS TO NAVIGATION

The appropriate aids to navigation will be installed on the dock. Lights will be installed in accordance with the Coast Guard Regulations (for detailed data, see Code of Federal Regulations in Title 33, Chapter 66). In addition, radar signal devices will be installed as recommended by the Masters Mates and Pilots Union so that the pilots will be able to locate the dock in foggy weather.

NAVIGATION RULES

As noted in the regulations quoted above, specific regulations and rules of the road for this portion of the Sacramento Channel have been established. These rules provide for maximum control of vessels guided by experienced pilots. Warnings to other vessels that will transit this area of the Sacramento River will be contained in appropriate Notices to Mariners and coordinated in future editions of the United States Coast Pilot 7, Pacific Coast, California, published by the National Oceanic and Atmospheric Administration. The June 1975 edition of the Coast Pilot shows the following restrictions:

> "Shallow-draft Speed Restrictions in the Delta Region
>
> "Because of a combination of high stream flows and high tides, the Corps of Engineers advises that the following shallow-draft speed restrictions will be in effect until further notice:
>
> "All shallow-draft vessels are restricted to speeds of 5 miles per hour during the period from 2 hours before to 2 hours after either high tides. These speed restrictions apply on all Sacramento-San Joaquin Delta waterways downstream from Courtland and Mossdale. All boaters are requested to use extreme caution to avoid damage to saturated levees. The Corps of Engineers advises the following restrictions on deep-draft navigation until further notice:

"1. Traffic to and from the Port of Sacramento shall schedule trips so that they pass Rio Vista Bridge within 1 hour either side of either low tides.

"2. Traffic to and from the Port of Stockton shall schedule trips so that they pass Prisoners Point within 1 hour either side of either low tides."

MITIGATION MEASURES

- Dock radar signaling devices should be installed in accordance with the Masters Mates and Pilots Union recommendations.

- Regulations of the Port of Sacramento and shallow-draft speed restriction information should be made available on a current basis to Dow-owned or other vessels using the dock.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
650 CAPITOL MALL
SACRAMENTO, CALIFORNIA 95814

REPLY TO ATTENTION OF SPKCO-O

29 August 1975

PUBLIC NOTICE NO. 5687

TO WHOM IT MAY CONCERN:

Application has been made to the Sacramento District, Corps of Engineers by The Dow Chemical Company, Western Division, P.O. Box 1398, Pittsburg, CA 94565 to install four pipelines, a dock and turning basin, water supply facilities, and wastewater disposal facilities as shown on the attached drawings. These facilities are part of Dow Chemical Company's proposed expansion of their Pittsburg Petrochemical Complex in Contra Costa County, and would produce plastic raw materials to supply a portion of the existing demand for such products in the United States, west of the Rocky Mountains. The planned expansion would be constructed on two separate sites: on a 250 acre parcel adjoining the existing plant near Pittsburg, Contra Costa County and at a new 2,700 acre site in the Montezuma Hills along the Sacramento River (Mile 4.3, right bank), three miles east of Collinsville.

SITE DEVELOPMENT

Pittsburg Site

The Dow Chemical Company presently operates a chemical production facility near Pittsburg, Contra Costa County. The Pittsburg site is bounded by New York Slough on the north, U.S. Steel's rolling mill and Continental Can Company's facility on the west, Stauffer Chemical Company's sodium metasilicate facility on the south, and the City of Pittsburg's Camp Stoneman Sewage Treatment Plant and undeveloped land on the east. About half of Dow's 500-acre site is currently developed.

It is anticipated that the new Dow facilities at Pittsburg would be constructed on the remaining 250-acre parcel adjoining the existing production facilities.

Development of the new production site would involve cut and fill over 25 acres to develop a relatively flat construction area suitable for the process and support facilities as envisioned in the general project description. A portion of the fill area is currently in light industrial use for settling ponds, etc., which would be brought up to a grade suitable for plant utilization. This would allow heavier structures, including tankage and light buildings, to be constructed in this area. The area to be graded is currently covered with oats, barley, and brome grasses.

On-site storm drainage would be diverted into the existing storm drainage handling facilities at the adjacent industrialized site. All process and sanitary wastes would also be connected to the existing and/or expanded on-site waste handling facilities.

The actual construction on this site would initially consist of the grading and filling operation and the road and rail development operation. All of this activity would be done in about six months. However, the actual construction of buildings, process units, waste control facilities, and shipping facilities would be conducted over a relatively long period of time--at least five years duration.

All of the cut material developed on site--about 200,000 cubic yards--would be utilized as fill. An additional 200,000 cubic yards would have to be imported and used as fill material in the northerly portion of the site.

Montezuma Site

The 2,700-acre Montezuma site is currently utilized for agricultural purposes. It is presently managed on a three-year rotational cycle: first year is devoted to raising barley, second year is devoted to sheep grazing, and during the third year the property is allowed to lie fallow. At present, the Montezuma site, as well as the majority of the adjacent property, is under contract with Solano County specifying it as an agricultural preserve. This designation is provided for by the California Land Conservation Act of 1965 (Williamson Act) which is applicable to agricultural lands and other lands compatible with such uses. Development of the Montezuma site is controlled by Solano County's General Plan--1990 for the Southeastern Solano County Planning Area.

The production facilities for those products which are normally transported by ship, barge, and tank car would be oriented to the Montezuma site due to the availability of land for tankage and the existing wide ship channel. For this latter reason, the Montezuma site is also conducive to receiving large shipments of the basic feedstock (petroleum naphtha) by either ship or barge. Since this site is presently undeveloped and in a remote area, it would be necessary to construct transportation facilities, water supply facilities, wastewater disposal facilities, as well as process units and storage facilities.

Grading. Extensive (9 million cubic yards) earth moving would be required to develop the Montezuma site. Cutting, filling, and compacting in place would be essential over the entire site to be developed. It is anticipated that approximately 600 acres of the 2,700 acre site would be developed for plant facilities by terracing a series of steps with all cut material being utilized in adjacent fill areas. It is anticipated that there would be four steps in 30-foot vertical increments away from the frontal river plain. The estimated quantity of earth to be moved to develop these terraces is 6 million cubic yards.

It would also be necessary to construct a new transportation corridor from the existing Collinsville Road and Sacramento Northern Railroad at Montezuma to the new site. Since an approximate level grade is essential for these facilities, it would be necessary to cut and fill along the majority of the five-mile corridor. It is estimated that about 3 million cubic yards of material would be moved to construct the necessary rail and road beds.

General site drainage would be altered to make certain that all runoff from adjacent areas would be diverted around the production unit terraces to assure that off-site drainage could not become contaminated by any of the production or shipping activities.

An additional site of about 150 acres would be developed in the lower plain to be used for water quality control and solar evaporation facilities. This site would be in the southeasterly portion of the property in the plain immediately above the River. In the past, the U.S. Army Corps of Engineers utilized this area for dredge spoil disposal. Therefore, the easterly third is filled to elevation 35 with sandy dredge spoils. The remainder of this site varies between elevation 10 and 25 and is presently encumbered by a U.S. Army Corps of Engineers' dredge spoil easement.

Approximately 10 months would be required to complete the necessary earth-moving activities.

Transportation Corridor. A new road suitable for heavy truck traffic and a new railroad would be constructed from the existing Collinsville Road and Sacramento Northern Railroad at Montezuma to the new plant site. The transportation corridor would generally follow Talbert Road from Montezuma easterly to the property line and thence in a sweeping curve to the PG&E high voltage power line right-of-way and southeasterly to the production units. It is anticipated that the road would remain north and east of the railroad to avoid unnecessary crossings. At present, Collinsville Road is a very lightly travelled, narrow two-lane road. Therefore, possible road improvements or increased maintenance might be needed to handle the increased traffic. The Solano County Industrial Development Commission is presently studying the feasibility of improvements including alternative methods of financing.

Production Units. The construction of the chemical production facilities would take place over a period of five to seven years. The production facilities (i.e., the ethylene, styrene, cumene, and phenol plants) would be constructed on the third and fourth terraces away from the River.

Storage Facilities. Since this portion of the petrochemical complex would emphasize large volumes of liquids (both raw material and products) it would be necessary to provide storage (tankage) facilities. Present planning indicates that these facilities (42 tanks with a total capacity of 3,350,000 barrels) would be constructed on terraces one, two, four, and five. The tanks, which would store naphtha, styrene, phenol, and acetone, would be constructed with internal floating covers to eliminate the emission of hydrocarbons.

FACILITIES WHICH REQUIRE DEPARTMENT OF THE ARMY PERMIT

Dock and Turning Basin. The naphtha would be delivered to the Montezuma site either by barges from San Francisco Bay Area refineries or by ocean-going ships from Alaska, Washington, or Southern California. Therefore, it would be necessary to construct dock facilities. In order to handle the water-borne traffic, it would also be necessary to construct a turning basin. This would involve dredging up to (depending upon final dock location) 500,000 cubic yards of river bottom material from a 57 acre site. Dredge spoils would be deposited adjacent to the existing dredge spoil disposal area on the river-frontal plain. The dock development area is characterized by coarse sands on the river bottom. Recent analysis have shown this material to be 70-80 percent sand, 10-20 percent silt, and 0-10 percent clay. The silty sediments occur near the shoreline and the sandy sediments occur beyond the 50 to 200 feet from the shorelines.

The dock would be a rather simple structure as it would only handle liquids and, therefore, would be a "pipe" dock only. This facility would be designed with emergency spill prevention measures similar to those at Dow's Pittsburg facility.

Water Supply Facilities. Freshwater needs for cooling and process water at the Montezuma facilities would be about 9,000 gallons per minute, peak flow, and 4,000 gallons per minute, average flow. Low salinity water would be diverted from the River during the period December 1 through March 31 (under appropriative rights) and stored in a 1,700 acre-foot reservoir to be constructed immediately east of the production units. These waters would then be used during periods of higher salinity river flow.

It is also anticipated that water would be diverted from the River on a continual basis (under riparian rights) and treated by reverse osmosis prior to use. This purified water would be blended with the high quality reservoir water to minimize energy consumption in the purification (reverse osmosis) process. Potable water for domestic purposes would be pumped from on-site wells and treated prior to use.

The production facilities would be designed to conserve water by reuse techniques. For instance, effluent from one production facility would be utilized as process water for another production facility. This method of use and reuse would save about 13 billion gallons of water annually.

Wastewater Disposal Facilities. The only planned wastewater discharge at the new Montezuma site would be reject water from the reverse osmosis unit utilized to upgrade the freshwater supply. Incoming river water would be treated by clarification and filtering to remove all settleable and suspended materials. These solids would be utilized as fill material on site. The water would then be pressured through a reverse osmosis membrane to remove about 90-95 percent of all total dissolved solids. In the reverse osmosis

process river water, pumped to a high pressure, is forced against a very thin plastic membrance. Very pure water is forced through the membrane leaving the dissolved solids behind. This water, containing the dissolved solids, is then "rejected" or removed from the system. The total dissolved solids, now in a concentrated form, would be returned to the River through a diffuser at the dock structure.

The purpose of the above procedure is to allow for a no-discharge system wherein all water leaving the plant site, other than reverse osmosis reject, would leave as a product or as evaporated material. As previously discussed, evaporation ponds would be constructed to handle the remaining process wastewater. These ponds would be constructed with double liners, similar to those presently in use in Pittsburg, to assure that the groundwater on site was not contaminated and that no seepage to surface waters occurred. It is anticipated that these ponds would be constructed on the lower plain adjacent to the River.

Sanitary wastes (sewage) would be treated on-site by means of biological treatment systems. The treated effluent would be utilized as process water thereby eliminating the need to discharge treated effluent to the River.

Storm runoff from non-production areas would be diverted around the production sites and into natural stream channels. Stormwater that falls on production or materials handling areas would be impounded and analyzed for all possible contaminants. If found uncontaminated, it would be discharged to the River. If found contaminated, it would be diverted to the process water handling facilities on-site.

Pipeline River Crossings. It is planned to "connect" the two sites with pipelines. Three pipelines carrying gaseous materials would cross the two rivers and Lower Sherman Island between the Montezuma and Pittsburg sites. A fourth pipeline would also be constructed to be used as a "standby" line to be used during maintenance operations, etc. One pipeline would transfer ethylene from the new site to Pittsburg; similarly, another pipeline would transfer propylene. The third pipeline would transfer hydrogen from Pittsburg to Montezuma.

The four, ten-inch, welded steel gas pipelines would be constructed in compliance with the National Safety Standards for gas transmission pipelines, would transport gaseous materials at 800 psi pressure, would be under cathodic protection, and would be buried for their entire length.

At the two ship channel crossings, the pipelines would be placed in a backfilled trench 10 feet below the existing bottom or projected maintained channel bottom, whichever is deepest. Due to the coarse sand in the area, the trenching would be done by side casting and recovery procedures. By utilizing this method, the original trench material would be used as backfill material eliminating the creation of dredge spoils. In the marsh crossing area (Lower Sherman Island), the pipelines would be installed three feet below the surface.

PUBLIC NOTICE NO. 5687 29 August 1975

The total estimated construction costs for the new facilities is expected to be about $500 million for the two sites. The work is scheduled to begin in 1976 with completion scheduled for 1982.

A draft Environmental Impact Report has been filed with Solano County and will be available from the County Planning Department after 8 August 1975. A permit issued by the Department of the Army does not give any property rights either in real estate or material or any exclusive privileges and does not authorize any injury of private property or invasion of private rights, or any infringement of Federal, State of local laws or regulations, nor does it obviate the necessity of obtaining State assent to the work authorized.

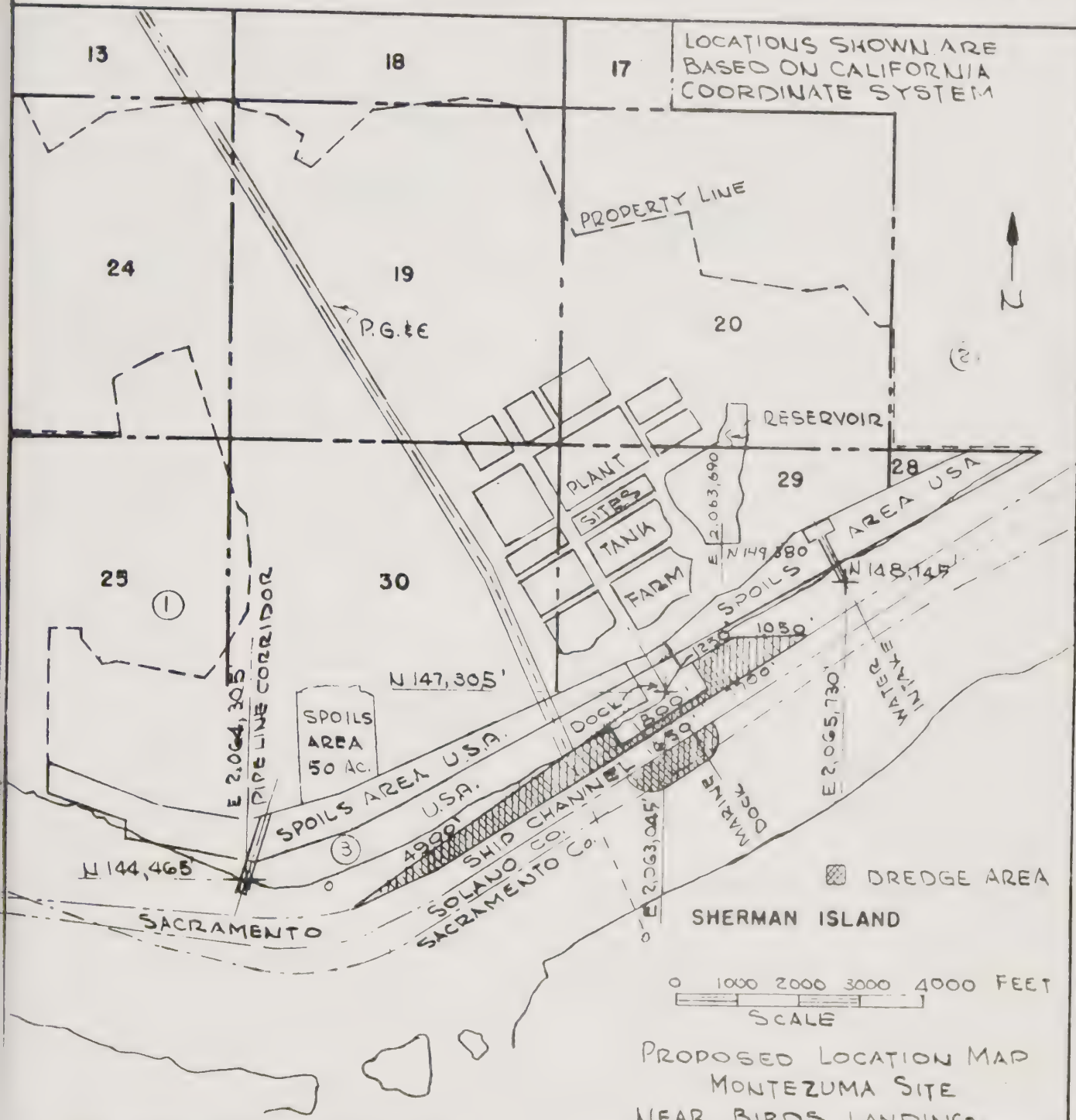
Interested parties are invited to submit in writing, on or before 29 September 1975, any comments they may have on the proposed work. The decision whether to issue a permit will be based on an evaluation of the probable impact of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources.

The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered; among those are conservation, economics, aesthetics, general environmental concerns, historic values, fish and wildlife values, flood damage prevention, land use classification, navigation, recreation, water supply, water quality and in general, the needs and welfare of the people. No permit will be granted unless its issuance is found to be in the public interest. Based on the information received, the proposed project would result in significant environmental impacts, and a Federal Environmental Impact Statement (EIS) will be prepared by the Sacramento District Corps of Engineers. Response to the Public Notice is invited to provide input for preparation of the draft EIS.

1 Incl
5 dwgs

F. G. ROCKWELL, JR.
Colonel, CE
District Engineer

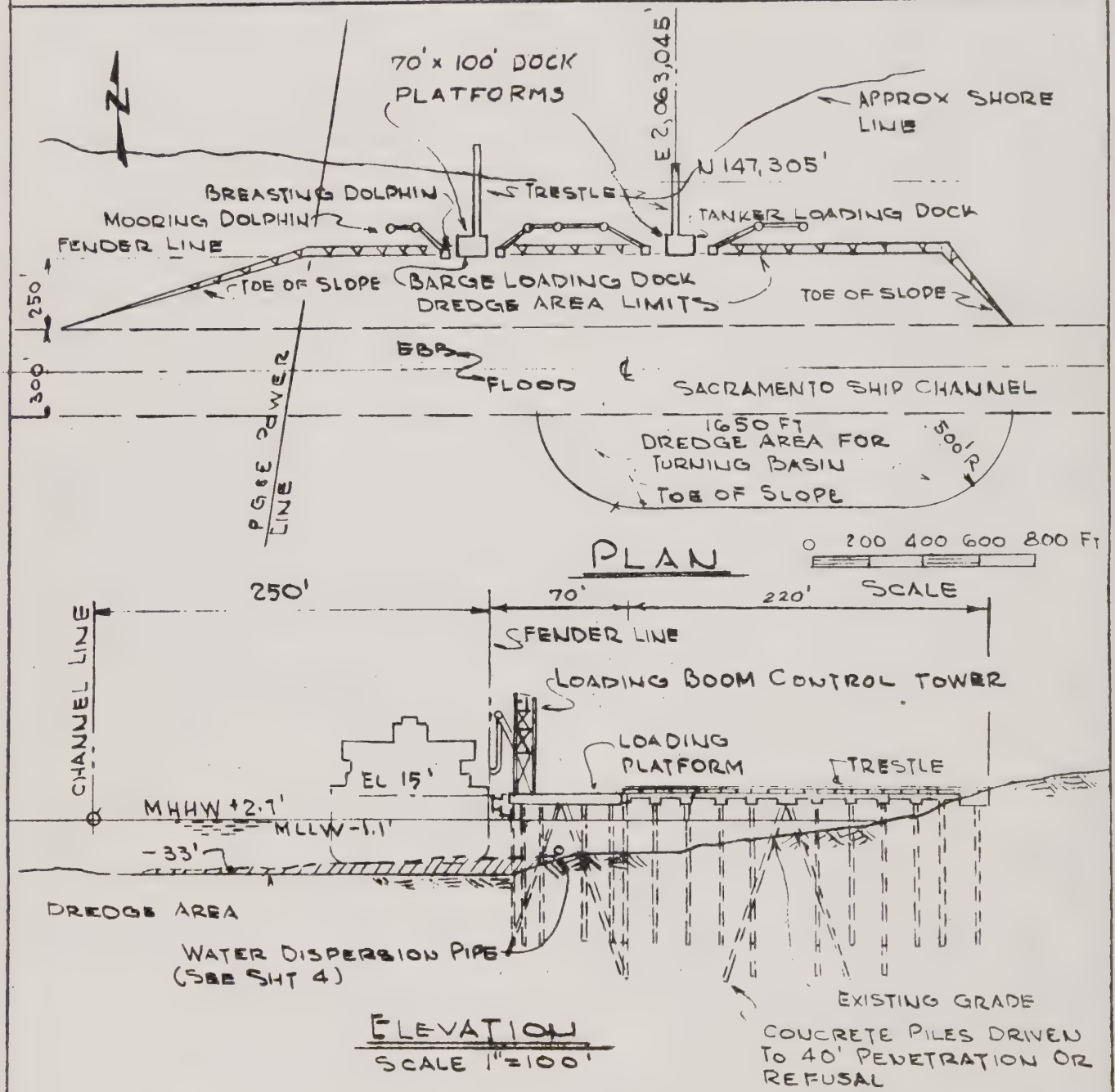
No. 5687



Proposed Location Map
Montezuma Site
Near Birds Landing
County of Solano - State: Calif.
Application by The Dow Chemical Co.
Date 6-4-75 Sheet 1 of 5

① Southern Pacific Railroad
② Robert Dozier
③ U.S.A.
Map from Nautical Chart 165 SC

No. 5687

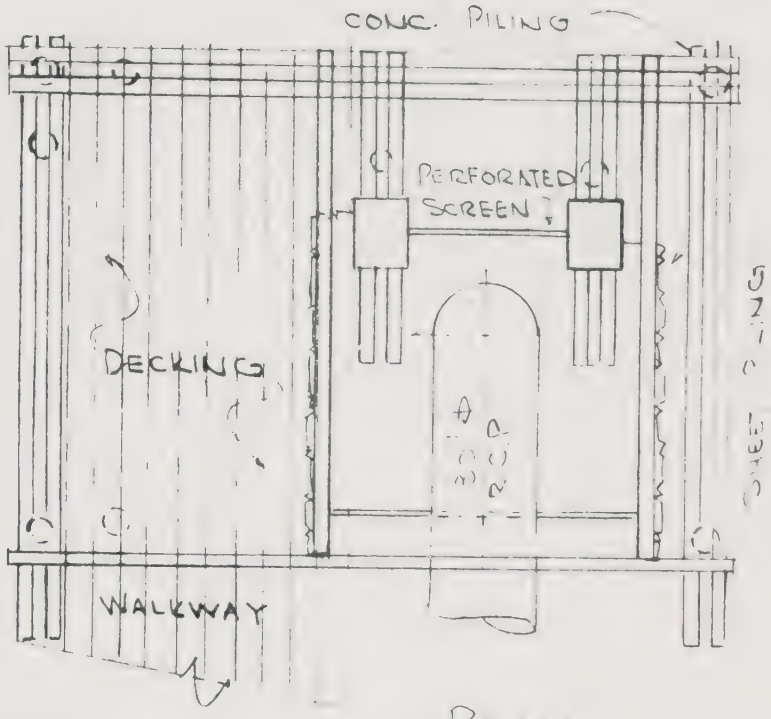


PURPOSE: DOCKING FACILITY
DATUM: MEAN SEA LEVEL

PROPOSED MARINE DOCK
IN SACRAMENTO RIVER
NEAR BIRDS LANDING
COUNTY OF: SOLANO STATE: CALIF
APPLICATION BY: THE DOW CHEMICAL CO.
DATE 7-9-75 SHEET 2 OF 5

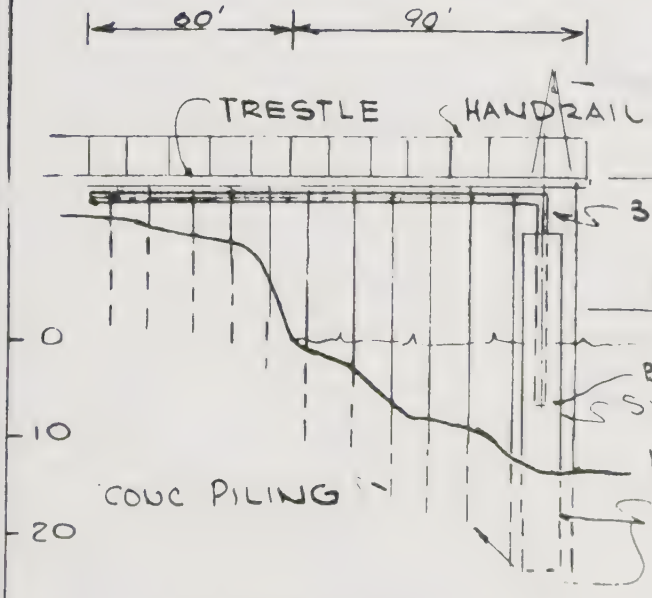
No. 5687

PERFORATED PLATE SCREEN WILL HAVE 5/32 ± HOLES ON 7/32" Δ PITCH WITH PLATE AREA OF 60 SQ FT AND WILL BE EQUIPPED WITH A CONTINUOUS PLATE CLEANING DIVICE



PLAN
SCALE 3/16" = 1'-0"

HOIST & FRAME TO RAISE SCREEN FOR MAINTENANCE

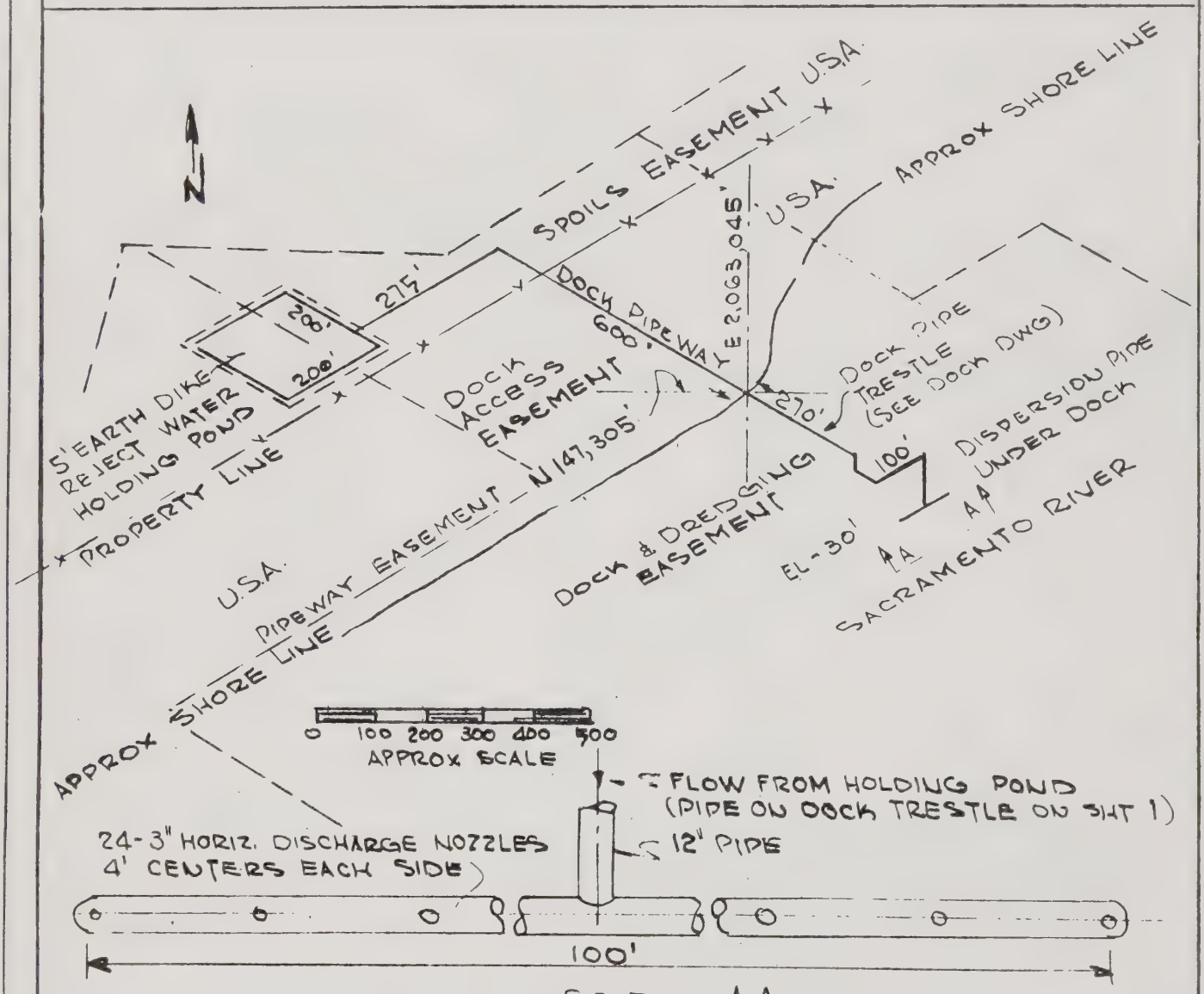


ELEVATION
SCALE 1" = 20 FT VERT
1" = 60 FT HOR

DATUM: MEAN SEA LEVEL

PROPOSED WATER INTAKE SIPHON IN SACRAMENTO RIVER NEAR BIRDS LANDING
COUNTY OF SOLANO - STATE CALIF
APPLICATION BY: THE DOW CHEMICAL CO.
DATE 6-4-75 SHEET 3 OF 5

No. 5687



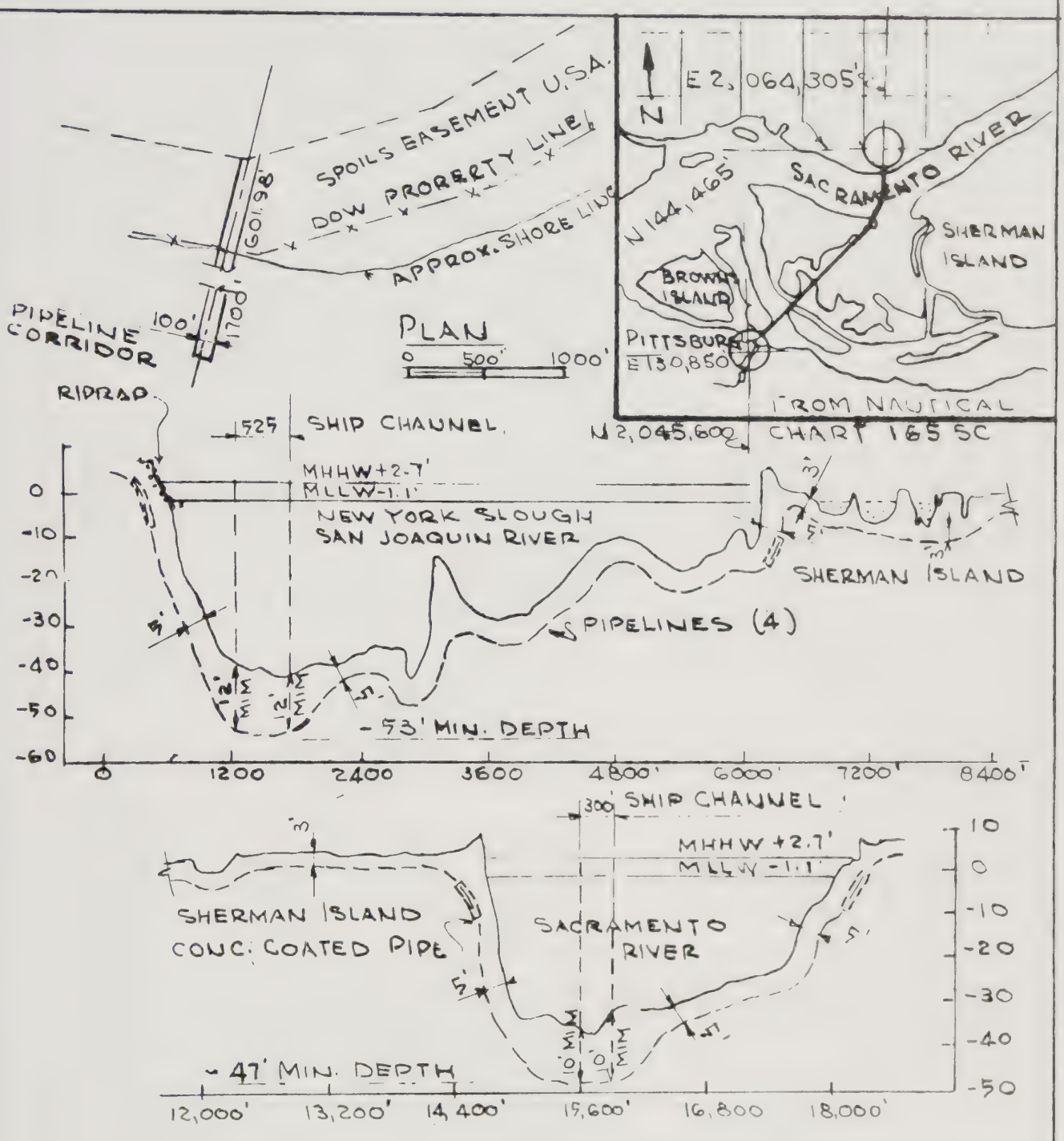
SECTION A-A
No Scale

DISPERSION PIPE TO LAY ON RIVER BOTTOM BETWEEN DOCK SUPPORT PILES AT 30' APPROX DEPTH FROM MEAN SEA LEVEL (SEE MARINE DOCK SKETCH SHT 2)

PURPOSE: WATER DISPOSAL
DATUM: MEAN SEA LEVEL

PROPOSED: REJECT WATER DISPERSION
IN: SACRAMENTO RIVER
NEAR: BIRDS LANDING
COUNTY OF: SOLANO STATE: CALIF.
APPLICATION BY THE DOW CHEMICAL CO,
DATE: 6-20-75 SHEET 4 OF 5

No. 5687



PURPOSE: GAS PIPELINES TO INTERCONNECT PLANT SITES
DATUM: MEAN SEA LEVEL
(PIPELINE DETAILS TO BE SUBMITTED AFTER DESIGN ENGINEERING)

PROPOSED: PIPE LINES (FOUR)
IN:
COUNTIES OF: SOLANO, CONTRA COSTA AND SACRAMENTO STATE: CALIF
APPLICATION BY THE DOW CHEMICAL CO.
DATE 6/20/75 SHEET 5 OF 5

Other
Responses XVI

CHAPTER XVI

OTHER RESPONSES

OCCUPATIONAL HAZARDS

The materials to be used and produced in the proposed complex of chemical plants have various degrees of toxicity. These chemicals are produced in large quantities in various locations throughout the United States and the world and are handled and shipped as commodity items in a safe manner as part of the everyday commerce of an industrial society.

Properties and Hazards Associated with Products to be Produced

A brief summary of the toxicity properties and some of the uses of the materials to be produced at the proposed petrochemical plant follows:

Polyethylene is a solid nontoxic hydrocarbon material used in many common plastic articles. Its many uses include film for food packaging and industrial wrapping, housewares, paper coating, wire and cable insulation.

Chlorine is a toxic gas used in large quantities in many chemical processes including treatment of water and wastewater. Its warning properties are very pronounced, producing severe irritation of the eyes, nasal passages, and pulmonary system. Concentration in the workplace atmosphere is controlled to less than 1 ppm. Severe injury is almost never incurred because of its warning properties.

Caustic is solid alkaline material, sodium hydroxide, which is widely used as a water solution in the manufacture of soaps, food processing, water treatment, and many other processes. It is a harsh irritant upon contact with the skin or respiratory tract. Workers in any operations which have the possibility of exposure to solid caustic or solutions are required to wear protective equipment such as chemical goggles, respirators, and protective clothing.

Vinyl chloride is a toxic gas which produces anethesia and dizziness upon acute inhalation exposure. Recent reports have shown that chronic exposure has produced angiocarcinoma, a rare form of liver cancer, in workers exposed over a period of years. The control measures instituted by the Occupational Safety and Health Administration, US Department of Labor, require stringent control of inhalation exposure to 1 ppm in air as a time-weighted average for an eight-hour per day, forty-hour per week exposure. Vinyl chloride gas is transformed by polymerization into a solid plastic, polyvinyl chloride (PVC). It has extensive uses in manufacture of pipe, floor covering, coated fabrics, films, and electrical insulation.

Propylene oxide is a liquid of slight to moderate toxicity which readily vaporizes to a gas at normal ambient temperatures. It is classed as a moderate irritant to skin or respiratory tract upon acute exposure and has anesthetic effects. It is used as a building block in the production of many other chemical raw materials. This subsequent processing changes its chemical and toxicity properties. Among these end products are:

Propylene glycol used in manufacture of polyester resins
Polyester resins
Polypropylene glycol and gylcol ethers used in manufacture of polyurethane resins
Glycol ethers used in coatings applications

Ethylene and propylene are gaseous hydrocarbons of very low toxicity producing little or no irritation effects. High concentrations can cause anesthesia or drowsiness. These are basic materials used for subsequent chemical processing to polyethylene, propylene oxide, styrene, and other intermediates.

Benzene is a toxic hydrocarbon liquid most commonly encountered as a constituent of gasolines. Benzene can be absorbed through the skin upon contact with the liquid and produces skin irritation and burning. Acute inhalation exposure to high concentrations of the vapor results in narcotic effects on the central nervous system. Chronic exposures produce toxic effects on the blood-forming system with cumulative damage upon repeated exposure. Benzene exposure to both liquid and vapor in the work place is strictly limited by prescribed handling techniques. Vapor concentration in the breathing zone must be below 25 ppm as recommended by the American Conference of Government Industrial Hygienists (ACGIH).

Ethylbenzene is a moderately toxic liquid having irritating properties to the skin and mucous membranes and causes dizziness and difficulty in breathing. Precautions against exposure are similar to those for benzene, although the recommended maximum vapor concentration is higher. Ethylbenzene is used as an intermediate in the manufacture of styrene monomer.

Styrene is a moderately toxic liquid having irritating properties to the skin and mucous membranes. Exposure to low concentrations produces eye irritation and lachrymation. Exposures to high concentrations produce transitory narcotic effects. It is not considered a very toxic material because, under ordinary conditions, it does not readily vaporize. Long-term exposure of animals to high concentrations (over 1,000 ppm) showed only eye and nasal irritation. The work place atmosphere is readily maintained at levels considerably below the recommended maximum of 100 ppm (ACGIH).

Cumene is a toxic liquid producing some irritation of skin or nasal passages. Upon prolonged exposure at high concentrations of vapor it has a narcotic action after an induction period. Since it may have similar effects to those of other aromatic hydrocarbons, it is handled with the same precautions with a recommended maximum concentration in the work place atmosphere of 50 ppm (ACGIH). Cumene is a hydrocarbon intermediate used in the manufacture of phenol.

Phenol is a solid which is usually encountered as a water solution. It is a toxic and severely irritant material used in many disinfectant solutions as a bacteriacide. Phenol can be absorbed through the skin and produces severe toxic effects to many organs of the body. Chronic intake results in severe damage to the nervous system as well as internal organs. Vapor concentration is closely controlled in the work place below the maximum recommended 5 ppm (ACGIH). Phenol is used as an intermediate in a wide variety of chemical derivatives which are in turn used in manufacture of plywood, nylon, pharmaceuticals, wood preservatives, and agricultural chemicals.

Acetone is a low-boiling liquid of relatively low toxicity. It produces narcotic effects upon inhalation of high concentrations but is not known to have notable poisoning effects or to have produced injuries. The industrial hygiene threshold limit is suggested as 1,000 ppm of breathing air. Acetone is widely used in pharmaceuticals, coatings, and plastics as well as a building block for other products.

Unsaturated isomers of pentane and butane are liquids or vapors at normal ambient temperatures. These materials are of low toxicity and produce mild irritation. Inhalation of high vapor concentrations can produce drowsiness or narcotic effects. Maximum inhalation concentrations are high (in the range of 1,000 ppm) for some of these compounds. For others, the main hazard is that of displacement of oxygen resulting in suffocation.

Naphtha is a mixture of many hydrocarbons obtained by the distillation of crude oil. It contains various members of the paraffin, naphthalene and aromatic families similar to gasoline, kerosene, and other petroleum products. These materials have toxic properties similar to these mixtures. Naphtha is irritating to the skin and upon prolonged inhalation produces anesthetic effects.

Occupational Health and Safety Programs

The Federal Government has recognized the need for environmental and industrial safety by establishment of the Occupational Safety & Health Administration and the Occupational Safety & Health standards. The State of California has also recognized the need for occupational safety standards in the State of California's Administrative Code Regulation No. 5, Title 8. These laws have served as a basic guide for the creation of minimum safety standards in the chemical industry.

The Dow Chemical Company is committed to protecting the health of its employees. It has an established policy to provide a safe and healthful place for its employees to work, to conduct its operations with due regard for the safety and health of the community, and to alert users of its products to potential hazards (Dow, 1975).

The safety record of the United States chemical industry (frequency rate 4.2 disabling injuries per million man-hours worked) is considerably superior to that of total US industry (10.2 frequency rate). Dow's safety record is one of the best of the chemical industry (0.58 frequency rate), (National Safety Council, 1975). The industry's experience in safe handling of toxic materials has been built over the years with the growth of the industry. Dow has maintained an active internal industrial hygiene and toxicology study program for many years on the materials used in its operations with a

professional staff which is in continuous contact in the exchange of information with academic, governmental, and industry sources of similar investigations.

Mitigation Measures

- The Safety Department of The Dow Chemical Company would be responsible for seeing that all applicable Federal, State, industrywide, and Companywide occupational health and safety criteria or threshold limit values established for the various products are continuously in compliance.

- Adequate employee training programs would be developed so that all personnel will be able to avoid exposure to hazardous chemicals or unsafe conditions.

- Monitoring of employees and the work place would be the responsibility of the Corporate Medical Department, the Industrial Hygiene Department, and the Health and Environmental Research Departments.

- Employees would be instructed on their responsibilities for knowing and faithfully carrying out all operating and safety instructions and procedures. In addition, they would be encouraged to report all potential hazards or any changes in physical conditions which would be caused by occupational activities, or any change in the work environment that might result in changing exposure to toxic chemicals.

- The best available technology would be utilized in process facilities to assure the safest conditions in work areas and limit any exposure to hazardous substances in the plants and the surrounding environment.

RESOURCE CONSERVATION

The resource conservation aspects of the use of oil for manufacture of plastics has been questioned.

Energy and Resource Allocation

At the present time, approximately 6 percent of the oil used in the United States is used in the manufacture of plastics. Industries' sources indicate that this use is not nearly as

cost sensitive as heating and transportation fuel uses. Should the prices of oil continue to increase as a result of a world-wide shortage, it would appear that plastic uses could ultimately be the remaining use for petroleum. It is estimated that approximately 15 percent of the plastic uses are "throwaway."

A recent study, "Plastics: Resource and Environmental Profile Analyses," Midwest Research Institute, June 1974, studied six specific products. The following tabulation based on that study shows the energy and resource utilization to manufacture one of the products at the new facility.

Data for Manufacture of 1,000 Pounds of High Density Polyethylene	
Raw Materials, pounds (Ethylene - 1,040)	
Solvent	45.7 lb
Additives	3.0 lb
Energy	
Electric	390.0 kwhr
Natural Gas	2.5 scf
Water Volume	1,780.0 gal.
Process Solid Wastes	2.4 lb
Process Atmospheric Emissions	
Hydrocarbons	5.0 lb
Waterborne Wastes	
BOD	0.37 lb
COD	2.04 lb
Suspended Solids	0.62 lb
Transportation	250 ton-miles

Data for Fabrication of 1,000 Pounds of 1 Gallon HDPE Milk Cartons	
Energy	
Electric	358.0 kwhr
Water Volume	455.0 gal.
Process Solid Waste	1.0 lb

In general, it could be said that as long as oil is economically available and the percentage of throwaway use is small and carefully controlled, it is preferable to use plastics as opposed to natural materials such as fibre, wood, and stone and perhaps even steel and other structural metals. If an ultimate oil shortage is projected, increased use of natural

resources could be made at that time. The alternative is to increase the use of natural resources now with consequent problems associated with soil mineralization, resource depletion, erosion, and the multitude of environmental effects associated with such activities.

Recycle Potential

It has been estimated that plastic wastes represent about 2 percent of the solid wastes currently disposed of to land fill in the United States. These plastic solid wastes are not recycled today because of two factors: (1) The percent of plastics in the total solid wastes is too low to warrant economical separation and (2) the plastics, once removed from all other solid wastes, do not lend themselves to efficient separation by plastic type, i.e., polyethylene, polystyrene, and PVC are specific plastics each having unique properties but not easily separated by any physical means.

New methods for large-scale recycling are in development stages and are likely to achieve commercial acceptance as the value of hydrocarbons increase and as landfill areas diminish. One such method in early stage study by The Dow Chemical Company combines mixed recovered plastics with chlorinated polyethylene on a three to one basis. The combined plastic mass, i.e., the chlorinated polyethylene, polystyrene, and PVC, forms an "alloy" or fused mixture which itself has useful physical properties. What end uses are applicable to this fused mixture is yet to be determined.

Other potential recycle operations may result in utilizing the waste plastics for their fuel value. About 5 percent of the petroleum consumed in the United States is in plastic products (the other 95 percent is burned as fuel). The recovered plastics could be burned in appropriate municipal incinerators for heating value. This recycle system alleviates the need to physically separate various plastics or the need to find suitable end uses for "alloys" such as those described above.

About 85 percent of the plastic types proposed for manufacture from the Dow Petrochemical Project would result in long-term use. Examples of long-term use include thermal and electrical insulation, cushioning, pipe, lighting fixtures, and luggage.

These items are more readily recycled due to size factors and to increasing values with time as the availability of hydrocarbon feedstocks decline. A "scrap market" does exist for off-grade plastics (below prime specifications) which serves suitable end uses for consumer needs. One example is the reclaiming of polyethylene for recycling into drainage pipe.

INDIVIDUAL RESPONSES

Numerous organizations, agencies, groups, and individuals had specific concerns that are not covered in the preceding responses on major subjects. The significant concerns are responded to as follows:

US Army Corps of Engineers

In a letter from the Corps dated September 18, 1975, clarification was requested regarding replacement dredged material disposal area, costs, and acceptability. To the extent that Dow encroaches on the obligations to the Corps, those obligations must be satisfied with respect to cost and suitable alternative disposal locations. At present, Dow has no plans other than for its own maintenance dredging to fill any significant portion of the spoil disposal area. As part of the Corps permit process and its associated Federal Environmental Impact Statement, it would be appropriate to develop alternative locations and the environmental characteristics of each.

The Corps also requested that the report discuss the economic efficiency of the use of larger ships and the effect of that efficiency on the current Sacramento deep-water ship channel feasibility study. The proposed Dow facilities are not designed to accommodate deep-water vessels. Such information as the Corps may desire as part of the completion of its feasibility study should be requested directly from Dow.

Resources Agency

The memorandum from L. Frank Goodsen dated September 11, 1975, requests consideration of the impact of a major petrochemical facility in the Bay Area on the transportation of crude oil from offshore California. The proposed Dow petrochemical facility is not dependent on crude oil from offshore California production

nor on production transported from the Santa Barbara Channel. The total naphtha requirement for the facility is 37,000 barrels per day, a relatively small quantity when compared with the current western consumption of petroleum of about 2,000,000 barrels per day. Naphtha is a distilled fraction of petroleum and hence it will come from a refinery. Petroleum to the refinery can come by ship or pipeline and the petroleum production source can be on land, offshore, foreign, and Alaskan. It is expected that the primary source of petroleum production for the facility will be from Alaska.

If Alaskan oil were shipped along the California coast to the Gulf states processors there would be an increased risk of alongshore accidents, spills, and leaks. Petroleum ton miles would be reduced by the existence of Bay Area petrochemical facilities. The response on the subject of accidental spills deals with the subject of bilge pumping and potential environmental risks associated with Bay transport.

Department of Food and Agriculture

The comment from Robert M. Pratt, dated August 18, 1975. The Montezuma site is in the area of very limited access and the CALTRANS has not adopted the proposed freeways discussed in that area, particularly the primary north-south artery that would result in the construction of a new bridge to Contra Costa County. The project's impact without freeways is discussed in the section on Transportation.

Department of Fish and Game

Memorandum from James S. Leiby dated September 10, 1975, lists a number of considerations. The Dow Chemical Company has committed the existing and potential wetlands to wildlife. However, riparian marshland habitat fronting the River is not proposed to be protected by a 1,000-foot setback in all areas, particularly in the area of the dock and waste treatment facilities. No artificial bulkheads are planned to be constructed on the shoreline. Dow intends to establish either a freshwater or brackish water marsh in the riparian areas at the easterly edge of the property as a mitigation measure. The details of this mitigation measure will be coordinated with the Department.

While it would appear desirable to assure that the proposed pipelines crossing Sherman Island would parallel the existing pipeline, that would result in a higher degree of damage to vegetation and wildlife in terms of area affected and would result in longer water crossing of the Sacramento River. This additional pipeline (4,500 feet) is costly and creates an additional exposure risk.

Division of Mines and Geology

Memorandum of John W. Williams dated August 22, 1975, requests an accurate determination of the Antioch fault location. Such a determination is required prior to the design of the facilities, but the specific location would not provide information which would aid in determining the environmental impacts of the project. See the seismic response.

CALTRANS, District 4

The proposed freeway shown on Figure III-4 of the Draft was based on previous planning studies and has no legal status and should be omitted. To our knowledge, there is no up-to-date traffic data for Loveridge Road. Loveridge is a four-lane local service road that could carry a significantly increased volume of traffic. However, between its intersection with Highway 4 and the present Dow facilities, there are two railroad crossings at grade. This could present a significant traffic delay problem.

Association of Bay Area Governments

Letter from Revan A. F. Tranter dated September 17, 1975. The best way to assure that project information will be made available as it progresses is to undertake several of the mitigation measures proposed as necessary to reduce any potential growth-related impacts of the project.

The proposed Alaskan natural gas pipeline has no effect on the Dow complex. Dow is presently using some 15 million cubic feet per day and proposes to use about 35 million cubic feet in the future. All of this is expected to come from Dow's own production facilities in California which are estimated currently, without any additional sources, to provide enough gas for twenty years.

The alternative Pittsburg site would have significant advantages not only from the standpoint of environmental protection and economics, but from the standpoint of availability of labor and the reduction of commute and other service transportation needs. Reference should be made to the response on Planning.

The proposed bridge across the Sacramento River to accommodate Highway 113 was not considered an element of the transportation system; see the Transportation response.

City and County of San Francisco

Letter from Selina Bendix dated September 26, 1975. Geothermal power is one of the potential sources of energy for the Dow facility and the environmental impacts of its development have not been discussed. Such development can have potentially adverse effects on water quality and associated transmission lines may go through environmentally sensitive areas. These are issues that should be resolved after alternative power sources are evaluated.

Unless there are major changes in the size of the facility, there would not be a significant change in the environmental analysis. Dow's determination regarding the proposed facility size and the product mix is based on market conditions that is anticipated as well as an economic analysis of production facility size. It is not believed that any variations in environmental effects using alternative products or in reducing the scale of the operation would be significant enough to affect decisions regarding marketing plans.

The chapters on Navigation and Accidental Spills answer most of the questions and comments concerning those aspects of the project. A more detailed analysis of probabilities of shipping accidents and the impact of such accidents should be completed.

Contra Costa County Flood Control
and Water Conservation District

Letter from T. E. Burlingame dated September 3, 1975. The effects of waves created by additional ship traffic on existing or proposed levees have not been analyzed. Such analysis will be developed as part of the Corps of Engineers permit process and associated Federal EIS. In general, it can be said that the increase in ship traffic will proportionately increase the levee maintenance particularly in areas where channels are confined.

Solano County Department
of Public Health

Letter from Albert T. Vervais dated September 30, 1975. Request for an approved waste disposal area, fenced, washing equipment, and adequate drainage is appropriate if Dow proposes to dispose of any solid wastes on the property. Present plans are for off-site hauling to approved disposal locations.

City of Vacaville

Letter from Donald R. Foster dated September 29, 1975, expresses concern that the Dow facility will result in industrial development in the Southeastern part of the County to the detriment of other potential industrial developments in the County. The proposed industrial development in Southeastern Solano County according to the General Plan--1990 is heavy industry in nature and dependent upon major shipping access. It is not likely that additional highway-oriented transportation industries would locate in the Southeastern portion of the County. The recent location of the Anheuser-Busch brewery is an indication of an industry location based on alternative development needs.

Suisun Resource Conservation District

Letter from Glenn I. Wilcox dated September 2, 1975. The facility's water quality control ponds are in the Corps of Engineers dredge spoil easement. However, that easement has not been used for several decades and most of the area occupied by the ponds is already filled. The unfilled area would continue to be available for additional filling and ponds could be located and relocated as that activity progresses. The 45,000 yards of annual maintenance dredging will be placed in unused portions of the lower plain area. Arrangements will be required with the Corps of Engineers to assure that the rights of the United States are protected.

Sierra Club, Redwood Chapter

Letter and oral testimony from Cynthia Kay dated September 12 and 4, respectively. Planning emphasis on the Southeastern Solano County planning area is due to the fact that area has recently been planned for future uses within the area while giving consideration to the remainder of the County. Also, the Plan represents the expressed local opinion regarding development; see Planning response.

Evaporation ponds would be located above the 100-year flood level and protected by Corps of Engineers maintained levees.

A list of fabricators and distributors most likely to use Dow products is not available since the exact product mix and the timing of manufacture will not be known for several years.

In recent weeks, the discussion between Dow and the County Planning staff have resulted in an agreement that 834 acres should be prepared for rezoning for industrial uses with the remainder of the land remaining in agricultural use.

The proposed Solano Irrigation District water supply project is not related to the Dow program. Dow's water program is discussed in detail in the water response.

Environmental Defense Fund

Letter from Zach Willey dated September 29, 1975. The Dow petrochemical facility would be one of several existing petroleum processing facilities in the Bay Area. The character of the region is not likely to change as a result of the facility. Sensitivity to changes in oil availability are discussed in the resource conservation response.

The Dow facility would have an adverse effect on the aesthetic considerations for a certain part of the Delta. Otherwise, it would have no adverse effects on the San Joaquin Delta Master Recreation Plan. It should be pointed out that the property is crossed by PG&E high-power transmission facilities and across the river from a major highly visible power facility. Numerous other power lines cross the Western Delta. See Williamson Act.

The statistically probable number of tanker collisions would be estimated as part of the detailed spill prevention plan suggested as a mitigation measure.

No oil should be released in the Sacramento River or Bay from ballast of tankers except in violation of present Coast Guard rules. However, if it should be released, it would have an adverse impact on all environmental areas in the estuarine system, and this is discussed in the accidental spill response section.

The proposed zone change is consistent with the General Plan--1990 for Southeastern Solano County. The Citizens Committee actions,

which are part of the Plan, the Plan itself, and associated facilities such as the ship terminal proposed in the Plan all anticipate the development of waterfront industry at Collinsville and in the adjacent areas to the east.

The appropriateness of including setbacks, safety requirements, and other limitations in zone changes is a matter for County determination. The mitigation measures presented in this response and the original report might be the subject of such conditions. However, attempts to impose limitations on project aspects currently being regulated by other State and Federal agencies would lead to confusion and could be counterproductive.

Northern California Committee for Environmental Protection

In various communications, the Committee made a variety of comments. A more detailed schedule for construction is desirable and should be provided as planning develops in connection with obtaining various permits. The project is subject to permit review of the Department of Fish and Game, State Lands Commission, and the Corps of Engineers, among others, who have in the past provided stringent conditions on the timing of water-related construction.

The designation of "high polluting industries" as it relates to polystyrene, polyethylene, polyvinylchloride, and rubber is based on historic conditions and not on current standards of the Environmental Protection Agency or the State of California. Any potential adverse effects from these industries resulting after compliance with State and Federal regulations would be the subject of evaluation of individual EIR's associated with those facilities.

San Pablo Historical Society

Letter from Anna S. Gaumer (undated) requested an archaeological investigation. Such an investigation has been conducted and includes the following conclusions.

Recent archaeological investigations have uncovered no hard evidence that Lower Sherman Island has ever been inhabited. Surface visits, aerial reconnaissance, and extensive literature searches have been made uncovering one written comment in 1811

that nine "campfires" were seen north of Antioch. The most interesting aspect of Lower Sherman Island is the significant peat deposits beneath the Island. The State Department of Parks and Recreation reports these deposits are formed to depths of 60 feet and contain an historical record of siltation going back several thousand years. Dow's pipelines will be laid very near the surface and little if any disturbance of these deposits will occur.

Solano Citizens Access to Planning

Letter from Michael Garabedian dated September 30, 1975, raised many issues that were covered in other portions of these responses. However, he dealt at length with detailed specifics of most pages and paragraphs of the EIR. These comments are available to assist project planners but do not appear to raise additional issues of significance as they relate to decisions pending before Solano County. In this regard, it is interesting to note the Memorandum of Decision No. 147426 of the Superior Court of Contra Costa County dated September 5, 1975, which is quoted below:

> "It need not be exhaustive, include all potential comments, nor be perfect, but is adequate if it provides the decision-makers with information which enables them to make a decision which intelligently takes account of the environmental consequences and is adequate and complete."

The decision regarding lead agency was made jointly by Solano and Contra Costa County Planning Commissions on the advise of their staffs. Solano was selected since there will be a slightly higher capital investment in the County and since the Contra Costa County site is already zoned for industrial use and owned by Dow.

Requests for information on design details contained in comments on page I-1, I-2, I-5 and in many other areas cannot be answered until final design of all processing units are completed. Some answers will be available as each unit is proposed for completion. Many answers have elements of trade or process confidentiality. The request for substantiation of West Coast demand projections on page I-1 can be answered by Table XVI-1.

TABLE XVI-1

GROWTH RATES AND WESTERN UTILIZATION
OF PROPOSED DOW PRODUCT
1972-1984

Product	Growth Rate 1972-1984 (percent)	Western Utilization (percent of National)
LDPE	10	11
HDPE	10	11
Vinyl chloride	9	9
Styrene	8	9
Propylene oxide	10	11
Phenol	7	11
Acetone	5	6
Caustic soda	5	8

The use of technical and other terms which are not familiar to the laymen is unavoidable in discussing a project of this complexity. Various terms have been defined to the best extent possible and commonly available basic scientific and industry references can provide the definitions of all terms used in the EIR.

Ms. Christina Drane

Letter dated September 8, 1975. Reference is made to the response to Ms. Gaumer. The project will be required to comply with the National Historic Preservation Act in connection with permits obtained from the US Army Corps of Engineers. Excavation on Sherman Island will be only three feet deep and investigative work should be undertaken as part of the construction program.

Mr. Robert B. Hamilton

Oral and written presentations dated September 4 and 18, and 9, respectively. The possibility of fires on Suisun Marsh caused by

an increase in the number of careless drivers on Collinsville Road could be a significant problem and County and local fire officials should prepare a preventative plan in this regard.

The responsibility for payment of road maintenance costs is a matter of Solano County policy.

The land price and the ability of others to purchase the land depends on private transactions between private individuals. Dow has an option on the property and should Dow fail to exercise the option, it is presumed that others could purchase the property.

The potential unemployment when the project ends has not been considered because the history of such projects, particularly with an investment in the range of half a billion dollars, is that they are not likely to be abandoned, at least in the foreseeable future. Obviously, if such an abandonment took place with this industry and perhaps other related industries, there could be serious economic dislocations which would require a variety of mitigation measures.

The future employment status of construction workers would be determined by the extent of construction activity available upon the completion of this project. If for instance either PG&E or ARCO or others should initiate construction in sequence with Dow, the employment base in this area could last in the Southeast Solano area and Contra Costa area for some time.

REFERENCES

The Dow Chemical Company, Chemicals, Human Health, and the Environment, 1975.

The National Safety Council, Accident Facts, 1975 Edition, 1975.

Unavoidable
Effects XVII

CHAPTER XVII

UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

The unavoidable adverse environmental effects are described in detail under appropriate topics in Chapter V of the Draft EIR and in Chapters III through XVI of this document. To provide a clear, separate identification, the unavoidable adverse environmental effects are summarized below.

CONSTRUCTION EFFECTS

Biological

- Construction will destroy most of the vegetation covering the Montezuma plant site. Estimates of extent of permanent destruction by vegetation type are as follows:

Freshwater Marsh (seasonal and permanent)	52 acres
Lowland Grassland	67 acres
Upland Grassland	298 acres
Total	536 acres

- The loss of 298 acres of upland grassland will diminish the amount of habitat and forage area available for seed-eating birds, rodents, and other animals. This, in turn, will reduce the number of animals present, and those displaced will increase densities in adjoining areas and compete with species inhabiting adjoining undeveloped areas.

- The completed facilities will restrict the movement of animals through the area encompassed by the facilities. This impact is of particular concern at the Montezuma site where access to riparian areas is very important.

- Loss of vegetation over a 40-foot construction corridor will be complete. Wildlife inhabiting this corridor will be displaced and have to compete for the limited remaining habitat with other resident species and some are likely to perish. This temporary loss would last for about two years until natural revegetation occurred. The marsh/open-water interface habitat would be the most severely impacted.

- The dredging that will be required for construction of docking facilities, turning basin, and pipelines will impact aquatic biota. Dredging will reduce the numbers of benthic biota as well as change the species composition of the benthic community within the dredged areas.

- Temporary erosion from exposed cut and fill areas will occur until vegetation has stabilized the slopes.

- Some terrestrial feeding grounds used by endangered raptors (e.g., Peregrine Falcon and Prairie Falcon) would be permanently lost.

Physical/Chemical

- The use of heavy earth-moving equipment would result in estimated increased air emissions as follows:

Emissions	Total Pounds Emitted Per Day Montezuma	Pittsburg
Particulates	<5	<5
Oxides of Sulfur	5	5
Carbon Monoxide	40	30
Oxides of Nitrogen	70	50
Hydrocarbons	10	5

- Several thousand pounds of particulates (dust) could leave the construction sites during the earth-moving phase of construction.

- Movement of construction equipment and supplies and personnel to the two sites would result in increased air emissions as follows:

Pollutant	Total Pounds Emitted Per Day Montezuma	Pittsburg
Hydrocarbons	120	80
Carbon Monoxide	930	605
Oxides of Nitrogen	70	45

- The ambient noise levels at the Montezuma site would increase from about 70 dB(A) to about 80 dB(A) while at Pittsburg the ambient levels will remain at about 80 dB(A) during construction.

- The aesthetics at the Montezuma site would be changed from a pastoral scene to an industrial scene.

- About 800 acres (600 acres at Montezuma and 200 acres at Pittsburg) would be changed from agricultural uses and/or open space to industrial uses.

- Dredging activities would be a hazard to navigation for about a one-month period.

- The Solano County Public Works Department estimates that the Shiloh-Collinsville Route to the vicinity of the Montezuma site will need to be resurfaced and maintained to handle the projected increased construction traffic. Estimated cost for this interim road would be about $217,000. The cost of a new road at Talbert Lane is estimated at about one million dollars.

- The Solano County Public Works Department estimates that a new access road following Collinsville Road from Highway 12 to Talbert Lane should be completed prior to operation of the new facilities. It is estimated that the new access road would cost about $3.5 million.

- An energy commitment of about 50,000 gallons of diesel fuel would be required for the earth-moving activities and an additional 540,000 gallons would be required to deliver construction supplies to the two sites.

- The construction workers would utilize between 870,000 and 2,160,000 gallons of gasoline (based on an average of two to three per car) commuting to the job sites.

- Significant quantities of concrete, steel, and bulk materials (wire, cable, pipe, etc.) would be used in constructing the new facilities as shown below:

Concrete	73,000 cubic yards
Steel	17,000 tons
Bulk Materials	49,000 tons

OPERATIONAL EFFECTS

Biological

- Wildlife would be displaced from the immediate vicinity of the production units due to human activity.

- Benthic organisms would be destroyed due to annual maintenance dredging of the dock approach area--estimated annual quantity of 45,000 cubic yards.

Physical/Chemical

- The estimated air emissions at the new facilities would be as follows:

Emissions	Total Tons Emitted Per Day	
	Montezuma	Pittsburg
Oxides of Nitrogen	10	1.5
Sulfur Dioxide	8	Nil
Hydrocarbons	1.5	1.0

- The new facilities would account for the following percentages of industrial air pollutant emissions in areas upwind or within 20 miles of the new facilities.

Pollutant	Percentage of Emissions
Hydrocarbons	6
Oxides of Nitrogen	12
Oxides of Sulfur	5

- Emissions from the proposed project will have a strong impact on local air quality at the project site. Petrochemical oxidant resulting from plant emissions may contribute toward exceeding air quality standards on site. Air quality standards for oxides of sulfur, oxides of nitrogen, and hydrocarbons may also be exceeded on site as a result of plant operations; this is dependent upon meteorological conditions, background pollutant levels, and the characterization of plant emissions.

- During periods of high humidity (≈90%) the cooling towers could create a localized fog situation immediately adjacent to the new facilities.

- An estimated 37,000 barrels per day of naphtha would be required to operate the new facilities.

- An estimated 146,000 kilowatts of electrical energy would be required to operate the new facilities.

- The 1980 average daily traffic on Solano County roads near the Montezuma site will greatly increase due to employees commuting to and from the new Dow facilities as shown below:

	Average Daily Traffic Without Dow	With Dow
Shiloh Road	150	770
Birds Landing Road	120	430
Collinsville Road	200	1,130

- The project might increase peak-hour traffic on Highway 12 east of Fairfield by 10 percent.

- The increased traffic in the vicinity of Montezuma site would lead to increased accident rates, even with the necessary road improvements.

- There will be a six percent increase in total Bay-Delta waterborne commerce (using 1973 as a base) both in terms of tonnage shipped and number of vessels while tonnage of hazardous cargo moving through the Golden Gate will increase about five percent.

- The increased shipping in the Sacramento River at the Montezuma site would result in an 18-fold increase over the 1973 total tonnage of hazardous materials transported on three miles of the Sacramento River.

- Shipping of caustic soda from the Pittsburg site amounts to an estimated 58 percent increase over 1973 shipments of hazardous cargo on the San Joaquin River.

- The increased rail traffic, 4,900 cars each year, would result in the likelihood of an accident involving a railcar carrying a Dow product once every six months.

SECONDARY EFFECTS

- The estimated air emissions associated with increased traffic to and from the new facilities (assuming no car pooling) would be as follows:

Emissions	Pounds/Day
Hydrocarbon	300
Carbon Monoxide	3,200
Oxides of Nitrogen	260

GROWTH INDUCEMENT

- The Dow facility, unlike basic community service extensions, will not make industrial growth easier in Southeastern Solano County. However, it will add to a developing industrial growth climate and, if approved, will constitute a policy, although not legal precedent, with regard to further industrial development in the area.

- The local service requirements of Dow employment could result in the need for additional community services, particularly in Rio Vista, but perhaps also in Fairfield, Vacaville, Antioch, and Pittsburg.

PROBLEMATICAL

- Possible ground surface rupture beneath the rivers due to movement along the Antioch fault could affect the four pipelines connecting the Pittsburg and Montezuma sites. For a fault length of about 20 miles and a maximum credible earthquake of Magnitude 5½, the fault displacement could be on the order of 1 to 2½ feet. If the three pipelines ruptured, 18,000 pounds of ethylene gas, 119,000 pounds of propylene gas, and 300 pounds of hydrogen gas would be released to the atmosphere.

- A hazardous material spill, either accidental or deliberate, could occur during ship or barge transit through the Bay to the new Montezuma site on the Sacramento River. The extent of the spills' effect, however, would depend on location, size of spill, material spilled, and river conditions.

- Since several products would be shipped by rail and truck, there would also be the potential for a hazardous material spill on land.

- Several types of small chronic spills could occur at the dock as well as the rail and truck loading areas. These include the discharge of ballast or bilge water, connection hose leaks, dock washings, and other minor incidents.

Mitigation Measures XVIII

CHAPTER XVIII

MITIGATION MEASURES

The Draft EIR, dated August 1975, and responses included in this Supplement describes a number of impacts of the proposed project. Some of these impacts can be avoided altogether, and others can be reduced by implementing a series of mitigation measures. The mitigation measures shown in this section include those described in Chapter VII of the Draft EIR as well as additional measures developed as part of the preparation of this final document. Many of the measures are interrelated. They will require future actions by Dow, the three counties, regional, State, and Federal agencies.

GROWTH INDUCEMENT

- The industrial growth-inducing effects of this project in Solano County could be significantly mitigated by adoption of County policies regarding industrial development and the establishment of criteria for acceptable industrial and residential uses.

- To minimize any adverse impacts associated with the proposed development and to assure appropriate planning for accommodating any future industrial development in the area, Solano County should reaffirm its policy opposing urban development in unincorporated areas, specifically in the southeastern part of the County. This could be added as an amendment to the General Plan for Southeastern Solano County or as a separate policy statement limiting urban growth only to incorporated communities.

- To mitigate any potentially adverse regional impacts and to assure that both local and regional planning precedes completion of the proposed project and planning studies for other industries, a subregional development study should be initiated in Solano County in cooperation with Contra Costa County and ABAG to provide detailed projections for land use, transportation, utilities, and public investments and employment. The result could be amendments to the General Plan--1990 Southeastern Solano County to reflect current policies and conditions.

- Wastewater planning in East Contra Costa County will be critical in the next year or two as the potential regional system is designed. Dow officials should establish frequent communication with City, County, and Wastewater Agency planners to insure that adequate capacity will be provided for population growth.

AIR QUALITY

- Since oxidant concentration is dependent upon emission rates of reactive hydrocarbons and the NO_2 content of oxides of nitrogen emissions, a more detailed characterization of the reactivity of plant emissions would be desirable to more fully gauge potential effects of plant emissions on area-wide smog levels, when design level data and details of reactivity of hydrocarbons are developed by Dow in the design process. This should be completed prior to filing construction permit applications with the Bay Area Air Pollution Control District.

- Air Quality Maintenance Planning will be completed in the Bay Area during the next two years. Dow officials should establish frequent communication with the State and local officials responsible for the Plan to insure that its facilities will be compatible with the details of that Plan with respect to both stationary and mobile sources.

- Feedstock and product storage facilities would be designed to minimize evaporative losses (e.g., internal floating roof tanks).

- Emissions from the facilities would be limited by applying the best technology available at the time of construction.

- Dust would be controlled to the maximum degree possible during construction by use of water trucks.

- Car pooling and/or the use of company vans or buses would be encouraged to minimize the emission of air pollutants from construction and operation employees commuting to the job sites.

WATER RESOURCES

Waste

- No wastewater except reverse osmosis reject water is allowed to be discharged at the Montezuma plant.
- Recirculating flow cooling towers will be used at both plant sites to discharge excess process heat rather than use the River as a heat sink.
- Evaporation ponds will have a double seal to insure no escape of water into the soil.
- Additional Regional Board certification of the ponds will have to be made prior to construction approval.
- A system to scare birds away from the ponds should be installed and utilized whenever necessary. Ponds shall be carefully fenced to avoid wildlife contact.
- An additional NPDES permit may be needed for rainfall runoff discharge and for dredging spoils decanting.
- All nonplant site runoff will be intercepted and conveyed around the developed area to River discharge.
- Reverse osmosis reject water will be run through a heat exchanger with incoming water to extract most of the heat buildup encountered through the reverse osmosis units.
- Initial dilution of reverse osmosis reject water will be about 100 parts River water with one part waste discharge. This system will involve an outfall diffuser underneath the dock with several discharge ports jetting the reject water into the River for quick dilution.
- Erosion control practices suggested by the Suisun Resource Conservation District will be followed closely and Dow staff must work with District and SCS personnel, if necessary, to minimize soil losses and water quality impacts.

Water

- Fish screens, louvers, and other devices as suggested by Department of Fish and Game staff will be used at the River diversion structure.

Dredging

- Dredging would be scheduled to avoid peak movements of anadromous fish.
- Dredging would be done in such a manner that sedimentation would be minimized (e.g., side-casting technique for pipeline crossings and suction dredging for dock and turning basin).
- Decanting at the spoils disposal site shall be closely monitored for groundwater pollution.

Air

- More detailed analysis of downwind impact of cooling tower drift should be undertaken prior to construction approvals by the Air Pollution Control District. These studies have not been completed yet due to lack of final design of cooling towers.

HAZARDOUS WASTES

- The facilities that should be designed will include the newest, most up-to-date technology available for use in the petrochemical industry at the date of their final design and installation. Bearing this in mind, detailed information on waste generation from currently operating, perhaps very old plants, will not be a valid data set for new and modern facilities. This new technology has been used throughout the EIR.
- The Dow Chemical Company should stringently adhere to all existing and future regulatory and industry assumptions regarding criteria related to the handling, storage, transport, and disposal of all solid waste materials.

- Where outlets or markets exist, materials suitable for recycling should be utilized to the fullest extent possible.

- In-plant recycling should be incorporated into the design of the plants to maximize the utilization of natural resources.

PLANNING

- To assure that the plans of Solano County are consistent with the regional goals and objectives, it would be desirable to strengthen planning ties between Solano County, Contra Costa County, Sacramento County, ABAG, and other agencies undertaking single-purpose regional planning. This need not require a formal institutional arrangement, although it may be desirable. Joint task forces working on specific plan elements might be a satisfactory way to assure cooperative planning.

- Mitigation measures for growth inducement and the Williamson Act involve planning issues, particularly the need for effective detailed planning for industrial development in Southeastern Solano County.

TRANSPORTATION

Phase I - During Construction

- As a minimum, additional maintenance effort should be undertaken as soon as site operations begin. Maintenance operations should begin on the Collinsville access route as soon as construction operations begin.

- The County in cooperation with Dow should work out a schedule for road surfacing improvements considering Dow's plans regarding Talbert Lane improvement as well as the near-term needs of other properties in the area.

- Sheriff and Highway Patrol authorities should be asked to develop any additional measures required as a result of the anticipated peak construction traffic.

- Attention should be given to schedule construction shifts in a way that would minimize peak traffic on the Collinsville Road, and the weight and size of delivery trucks should be carefully analyzed to determine road impact as material shipments are scheduled.

Future - During Plant Operations

- At some point in the future it will be necessary to rebuild the Collinsville Road. The date should be determined as the result of a proposed transportation study to be undertaken by the County, giving consideration to other industrial demands in the area and the rate of construction by Dow of individual plant units and associated employment.

- Dow should give consideration to the establishment of a ferry service as discussed under planning aspects to reduce traffic loads on the project and possibly delay the need for Phase I or future improvements.

- Maximum use of carpooling would reduce peak traffic volumes. Company vans and shift scheduling are possible techniques that would reduce traffic volumes.

- The size, type, and frequency of truck deliveries to the site can affect road maintenance and improvement needs. These factors should be considered when scheduling truck traffic.

WILDLIFE AND VEGETATION

- At the Montezuma site, the proposed industrial zoning would include approximately 834 acres of the 2,700-acre parcel. The remaining acreage should continue under present agricultural practices with the exclusion of certain areas which would be dedicated to the preservation and enhancement of wildlife and native vegetation. There are two areas where most of the nonagricultural flora and fauna are found--the riparian areas along the River bank and the marshlands (seasonal and permanent) that lie within the small valley that forms the eastern property line. These two areas, shown on Draft EIR Figure II-14, encompass about 140 acres.

- The valley is isolated from the proposed plant site and most human influences and provides an important wildlife habitat. Water is a limiting factor to plant and animal life in this area. Fresh water could be provided by a small reservoir or the existing windmill would be rehabilitated to establish a permanent water supply. As an alternative, process brine discharge could be used to maintain a brackish environment.

- Cover, roosting, and nesting sites are also limiting factors on this property. Therefore, native vegetation (e.g., tules, cottonwood, willows, blackberries, atroplex, and oaks) should be planted along the hillsides forming the drainage valley. The riparian vegetation along the River front should also be left unchanged as this area also provides cover, nesting, and roosting sites for numerous birds.

- At the Pittsburg site, trees should be planted around the periphery of the property thus providing a limited habitat for a few species.

- The Sherman Island pipeline crossing area should be restored to a level condition to promote regrowth of rushes and tules. In addition, several acres should be left open to create ponds for waterfowl resting areas.

- Prior to final selection of the location of pipelines which will cross Sherman Island, plans will be submitted to the California Department of Fish and Game for their review and approval. At that time, further mitigation measures may be required and detailed impacts of blasting potholes for wildlife enhancement will be assessed.

- Construction of the four pipelines will be done over a route that minimizes the loss of important riparian areas along the levees of Lower Sherman Island and the River front areas.

- Access to habitat areas should be kept open so all animals can fully utilize the undisturbed habitat which remains.

- Fencing should be constructed in such a manner that animals can get across roadways at specified locations. Vehicle drivers should be instructed via signs to slow down and proceed with caution in these areas.

- Construction measures should be instituted that minimize the destruction of vegetation and habitat areas.

- A positive program to flush out burrowing owls and burrowing animals from the construction areas should be designed and implemented prior to actual earth moving.

ECONOMIC IMPACT

- County offices and school officials should make every effort to secure latest industry projections of potential employment, both in construction and in operational phases, as the need for school facilities is considered.

- Community water and wastewater facilities, while currently adequate or under planning for improvement, could be made inadequate as a result of general growth in the area, part of which could come from the proposed facilities. The analysis of local community utility needs should be part of any continuing planning program involving the more regional aspects of industrial development in Southeastern Solano County. This planning effort is discussed in the section on growth inducement.

WILLIAMSON ACT

There are a variety of measures that could mitigate the effects of canceling the contract on the property.

- To improve the contiguous nature of this particular facility to other industrial urban developments and reduce secondary impacts, waterborne transportation could be developed between the existing Pittsburg and Montezuma sites for personnel or other goods and supplies. This transportation link would reduce the demand for public facilities in Southeastern Solano County and would facilitate the ability of current Dow employees involved with the Pittsburg plant to continue to reside in Contra Costa County.

- The Montezuma facility could be relocated on the site to take better advantage of the opportunity provided by the terrain for a visual buffer. This would have adverse environmental and economic effects that would offset its aesthetic benefits.

- It appears possible that because of existing taxing boundaries, neither the demands for services nor the tax base is likely to coincide precisely with impacts of the proposed development; and if major inequities appear, some interjurisdictional revenue sharing methods might be developed. The operation of the existing school

equalization law, the open space subvention program, and SB 90 will to some extent compensate for such inequities automatically. As developed in the Draft EIR, it is not likely that the demand for services by Dow-related employees will have a detrimental effect on existing communities and in fact is likely to have significant benefits, particularly in contributions to the countywide welfare and public service programs, and to the River-Delta School District.

GEOLOGY, SOILS, AND SEISMICITY

Geology/Soils

- The potential for landsliding on the Montezuma site would be minimized by prudent engineering during the design process, flattening cut and fill slopes to safe inclinations, and setting back structures from slopes. No slopes will be cut or filled near the River, so there is no potential for River scour triggering landsliding in the plant area.

- Filling the reservoir could trigger landslides, but the reservoir is relatively small and the risk would be minimized by proper engineering, dam design, and construction which are subject to review by the California Division of Dam Safety.

Seismicity

Ground Surface Faulting.

- Dikes and pipelines at the Montezuma site could be designed so that in the event that ground rupture occurs due to active fault movement, there is only a remote chance of a failure. Furthermore, the impact of a failure of pipelines could be minimized by seismic shutoff valves, and by site grading in the evaporation pond area so that any spill would be contained on land.

Liquefaction.

Montezuma--

- Any potentially liquefiable soils beneath the earth dam would be excavated prior to construction both

for safety reasons and to remove any pervious layers beneath the dam which might permit excessive underseepage.

- It appears that the only effect from liquefaction in the dock area would be differential settlement of the ground surface as a result of settlement of liquefied soils. These settlements would likely be only an inch or two, and flexible pipeline design would likely prevent pipeline rupture. Seismic shutoff valves would help minimize pollution from any unexpected pipe breakage.

- It is unlikely that mass soil flow, i.e., a liquefaction-triggered massive landslide of the alluvium into the River, is possible. If during the final design, such landslides appear possible, a number of measures would be available to eliminate the hazard: in-situ densification of potentially liquefiable soils, chemical grouting, and cement grouting.

- The evaporation ponds are shielded by a 35-foot thick layer of partially saturated fill which overlies the alluvium from excessive post-liquefaction differential settlements; proper site grading would provide further assurance that wastes contained in the ponds would not contaminate the River.

Pittsburg--

- The consequences of liquefaction in the young alluvium at the Pittsburg site can be minimized by proper engineering design since the risk of massive landsliding or mass soil flow triggered by liquefaction is nil.

- Building damage could be minimized in design by planning a thick pad of nonliquefiable soil beneath lightly loaded structures or designing deep pile foundations for heavy structures.

Montezuma and Pittsburg--

- The consequences of a pipeline failure caused by ground settlements due to liquefaction of subsoils

can be minimized by using seismic shutoff valves for pipelines and by grading the site to contain liquid pipeline spills.

- It might be necessary to utilize deep burial of the pipeline along with a bed of strong, stable, compacted soil to reduce the magnitude of differential settlement. Flexible pipe design would be essential. Back-up systems, such as flexible hoses, might be installed around the main pipe to insure that the gas would be contained in the event of a pipe break.

- If liquefaction potential at any one location is found significant enough to pose a risk of foundation instability or rupture of a critical pipeline, a number of mitigating measures are possible to reduce the consequences of liquefaction which include utilization of deep pile foundation, other techniques such as in-place densification of sands, removal of liquefiable soils and replacement with nonliquefiable soils, and cement grouting of subsoils can be used to mitigate serious liquefaction hazards.

Differential Settlement.

- Seismic shutoff valves and proper site grading can both be used to minimize the consequences of any unexpected pipe ruptures caused by differential settlement; special designs and back-up systems might be required for critical pipelines or utilities.

Slumping, Lurching, and Landsliding.

- This hazard, which is only significant near the shoreline deposits in the dock area of the Montezuma site, can be largely mitigated by proper design.

Ground Shaking.

- The risk of structural damage caused by strong ground shaking can be largely mitigated by means of existing rational methods of earthquake-resistant structural design which include criteria set forth in such codes as the Uniform Building Code and methods developed recently modeling by computer analysis the response of the ground and structure to hypothetical earthquake shaking.

PIPELINES

Construction Impacts

- Construction should take place during that season which assures that disturbance of wildlife breeding activities will be minimized. After construction, the pipeline route should be replanted with native species to assure a rapid return to favorable conditions for the wildlife. The actual construction activities should be confined to the most narrow possible corridor to minimize adverse impacts.

- To create additional water surface in the Sherman Island marshes, the Department of Fish and Game requested that additional pothole habitats for waterfowl, fish, amphibians, and reptiles be provided by The Dow Chemical Company during construction of the four pipelines. Thus, the marshland would be maintained in a steady state as opposed to a gradual progression of filling and creating drier land. Although a temporary measure, the method is effective in the maintenance of a balanced, indigenous, wildlife community. The Dow Chemical Company has agreed to such a stipulation.

Pipeline Design

- In addition to the automatic closing valves on the north edge of the Sacramento River and the south edge of the San Joaquin River, careful consideration should be given to the incorporation of additional shutoff valves at the north and south edges of Sherman Island to reduce the amount of emissions in the event of pipeline failure. Special earthquake-anticipating design should be used in the vicinity of the Antioch fault crossing described in Chapter XII. The design should anticipate lateral and vertical movement and be done in conjunction with the determination of automatic valve shutoff spacing. Attention should also be given to maintaining independent structural integrity of each individual pipeline.

Operations

- In addition to continuous recording of individual pipeline pressures, regular trial operation of the automatic valves should be scheduled to assure continual operating readiness. Pipeline structural integrity should be assured by continuous cathodic protection on individual pipelines and records maintained regarding the current requirements to determine coating integrity.

Utility Planning

- Because of the likelihood of additional crossings of the Sacramento River and Delta area, consideration should be given by the Corps of Engineers to the establishment of a utility corridor which would result in common areas at various points along the River for pipeline crossings. Consideration should include possible adverse effects of locating pipelines in close proximity to others considering materials conveyed and advantages of avoiding numerous crossings and potential interference with construction or navigation activities.

Pipeline Failure Emergency Plan

- A pipeline failure emergency plan should be prepared as part of the spill contingency plan recommended in that response. It should include reports monitoring for leaks, valve closure procedures, and a plan for evacuation of the immediate vicinity of cross-channel pipeline failure.

ACCIDENTAL SPILLS

An analysis of the probability of hazardous material transport should be made as part of the Spill Contingency Plan. Methods for this analysis are available and described in a paper entitled "Decision Analysis in Hazardous Material Transportation" written by A. S. Kalelkar, L. J. Patridge, and R. E. Brooks, Jr., and presented at a Joint Conference on Hazardous Substances held in San Francisco in September of 1974.

1. The Dow Chemical Company should develop a coordinated spill response plan with other industries with particular emphasis on on-site accidental spills.

2. The proposed Dow facilities and the potential for other similar facilities in the area make it essential that a detailed accidental spill response plan be developed. That plan would include an evaluation of accidental spill risk, classes of spills, detailed water quality and resource studies to determine the impacts of various types of spills of various materials, development of a response strategy, and finally an implementation plan.

A plan containing some of this information is required by the California Regional Water Quality Control Board, Central Valley Region by December 26, 1975, as part of its NPDES permit. It must include:

- Identification of the possible sources of accidental loss, untreated waste bypass, and contaminated drainage. Loading and storage areas, power outage, waste treatment unit outage, and failure of process equipment, tanks, and pipes should be considered.

- Evaluation of the effectiveness of present facilities and procedures and a statement as to when they became operational.

- Description of facilities and procedures needed for effective preventive and contingency plans.

- Prediction of the effectiveness of the proposed facilities and procedures. In addition, an implementation schedule containing interim and final dates when they will be constructed, implemented, or operational must be included. (Reference: Sections 13267(b) and 13268, California Water Code.)

After review of the technical report, the Regional Board may establish additional conditions which may be made part of the NPDES permit that was issued on September 26, 1975.

The spill response plan should be of similar detail as Standard Oil Company of California's Estero Bay Deep Water Terminal and Crude Oil Pipeline Project which was published in November 1973 as Appendix T to the Draft Environmental Impact Report for that project. That oil spill response plan included the following major items:

1. General Policy
2. Emergency Organization
   a. Structure
   b. Job Description
   c. Mobilization
3. Terminal Spill Response
   a. General
   b. Offshore Spills
   c. Onshore Spills
4. Pipeline Spill Response
   a. Leak Detection
   b. Precautions
   c. Emergency Operations
5. Spill Clean-up Resources
6. Special Services
7. Government Agencies
   a. Federal Requirements for Reporting Oil Spills
   b. State Requirements for Reporting Oil Spills
8. Consultants

Consideration should be given to the use of the USCE Bay-Delta model in predicting possible physical damage resulting from spills varying conditions. This could aid in the predictive part of the report which would include analysis of the type of spills (chronic, minor, or catastrophic), condition (floodtide, ebbtide, high-river, and low-river flows), area (Sacramento-San Joaquin Delta, Sherman Island, Suisun Marsh, Montezuma Slough, and downstream Bay zones), and toxicity to indigenous plants of the various products to be shipped. These in turn would be analyzed by source such as tanker, manifolds or attachment points, storage compartments, pipelines by location, terminal facilities, and spills from auxilliary equipment. Collisions between ships, estimates of damage, and possible losses of both cargoes should also be included.

The ultimate product would be a contingency plan which identifies men and equipment to be deployed based on predetermined patterns of impact resulting from both water and land-based spills.

SHIPPING AND NAVIGATION

- Dock radar signaling devices should be installed in accordance with the Masters Mates and Pilots Union recommendations.

- Regulations of the Port of Sacramento and shallow-draft speed restriction information should be made available on a current basis to Dow-owned or other vessels using the dock.

OCCUPATIONAL HAZARDS

- The Safety Department of The Dow Chemical Company would be responsible for seeing that all applicable Federal, State, industrywide, and Companywide occupational health and safety criteria or threshold limit values established for the various products are continuously in compliance.

- Adequate employee training programs would be developed so that all personnel will be able to avoid exposure to hazardous chemicals or unsafe conditions.

- Monitoring of employees and the work place would be the responsibility of the Corporate Medical Department, the Industrial Hygiene Department, and the Health and Environmental Research Departments.

- Employees would be instructed on their responsibilities for knowing and faithfully carrying out all operating and safety instructions and procedures. In addition, they would be encouraged to report all potential hazards or any changes in physical conditions which would be caused by occupational activities, or any change in the work environment that might result in changing exposure to toxic chemicals.

- The best available technology would be utilized in process facilities to assure the safest conditions in work areas and limit any exposure to hazardous substances in the plants and the surrounding environment.

AESTHETICS

- Painting schemes utilizing neutral tans and/or grays would be used to soften the aesthetic impact of the facilities.
- At Montezuma, all facilities would be set back at least 300 yards from the River.
- Vegetative screening would be utilized as appropriate (e.g., oaks and cottonwoods at Montezuma and eucalyptus at Pittsburg).
- Security fencing would be screened with bush roses, blackberry, or other climbing native plants to reduce the visual impact.
- All storm drainage channels would be constructed to appear as nautral channels.

ENERGY

- Car pooling and/or company buses or vans would be encouraged to reduce the amount of fuel utilized by commuters.
- Electrical energy would be derived, to the degree technological advances permit, from geothermal sources.
- Electrical energy derived from fossil-fueled sources (should geothermal prove impractical) would include combined cycle--joint power and steam--to maximize efficiency.

NOISE

- Landscaping with native vegetation (i.e., trees and shrubs) would be utilized around the plant perimeter to reduce noise levels.
- All applicable regulatory standards should be complied with.

ACKNOWLEDGMENTS

This Final EIR was prepared for and under the direction of the Solano County and Contra Costa County Planning Departments.

Solano County	Contra Costa County
Clayne E. Munk, Director	Tony Dehaesus, Director
Michael J. Harrold, Planner III	Arnold Jonas, Senior Planner

Assistance provided by J. B. Gilbert & Associates was under the direction of:

Jerome B. Gilbert, President
Keith S. Dunbar, Project Manager

Technical staff includes:

B. J. Miller, PhD, Sanitary Engineering
Gordon Lee Boggs, PhD, Aquatic Ecosystems
Perry L. Schafer, MS, Environmental Engineering
Kris P. Lindstrom, MPH, Environmental Health Sciences
Jane K. Powers, MS, Engineering Science

Special assistance in subject areas include:

Growth Inducement	- Stanford Research Institute
Air Quality	- Earth Metrics, Incorporated
Hazardous Wastes	- The Dow Chemical Company
Planning	- Michael J. Harrold, Solano County
Economic Impact	- Stanford Research Institute
Williamson Act	- Bill Geyer, California Research
Seismic	- Woodward-Clyde Consultants
Pipelines	- The Dow Chemical Company
Navigation	- Frank Boerger, Harding-Lawson Associates
Archaeology	- Patty Johnson, Consulting Archaeologist

Report production assistance was provided by:

William Reid
Michael A. Doran
Mary Jane Nauss
Lisa A. Vierra
Anna Rich
Linda Alexander
Linda Sturgill
Karen Richmond

U.C. BERKELEY LIBRARIES
C124892444